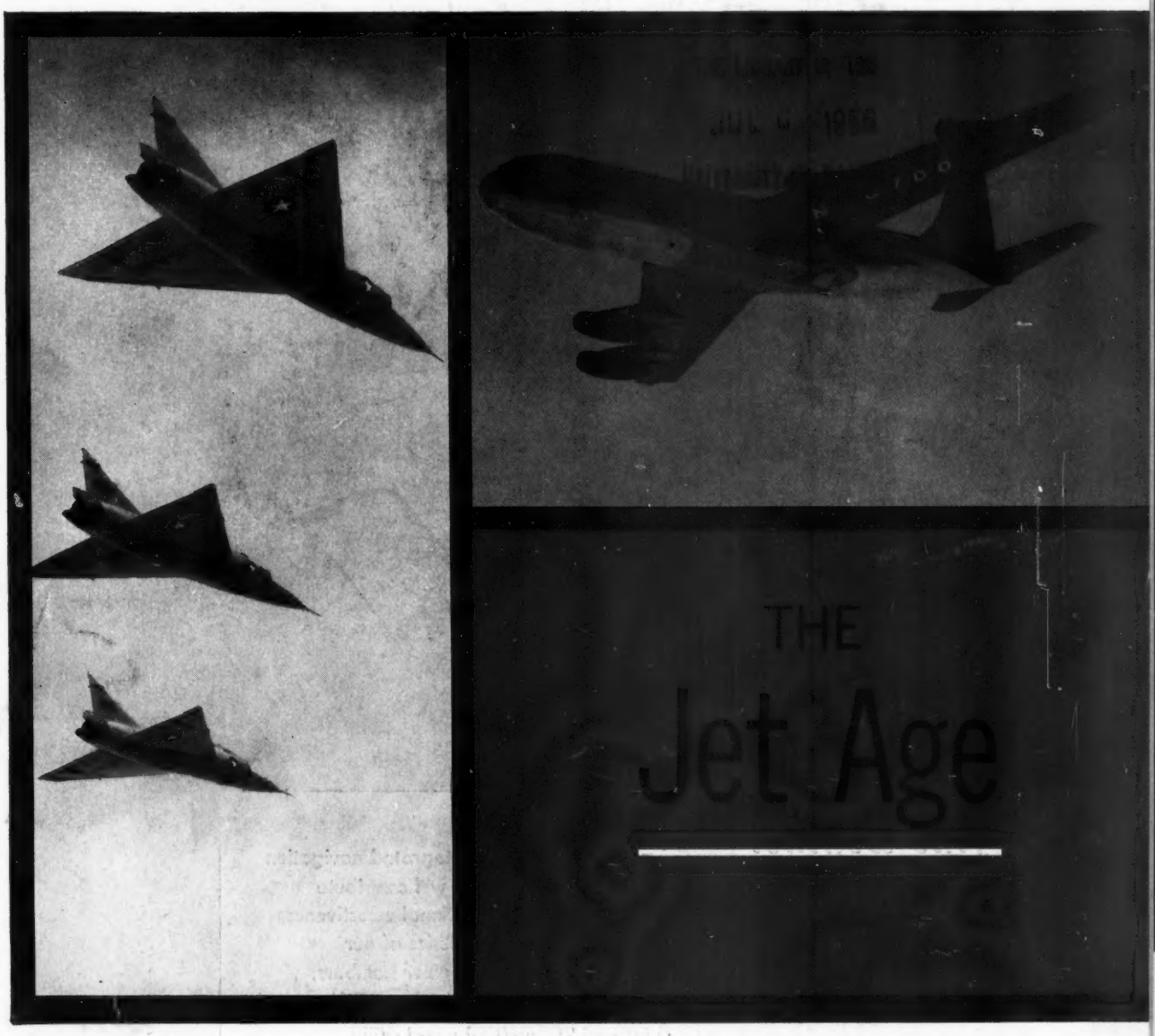
623.7405
AA
Ref

AIR FORCE

THE MAGAZINE OF AMERICAN AIRPOWER

March 1956 • 35¢



Complete Report on the Air Force Association's Jet Age Conference

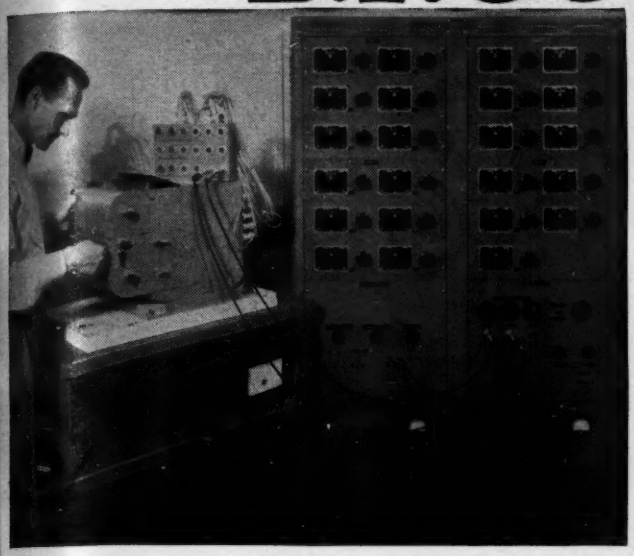
fine weather for **DUCKS** *and Arma* **"ALL-WEATHERED"** *fighter bombers*

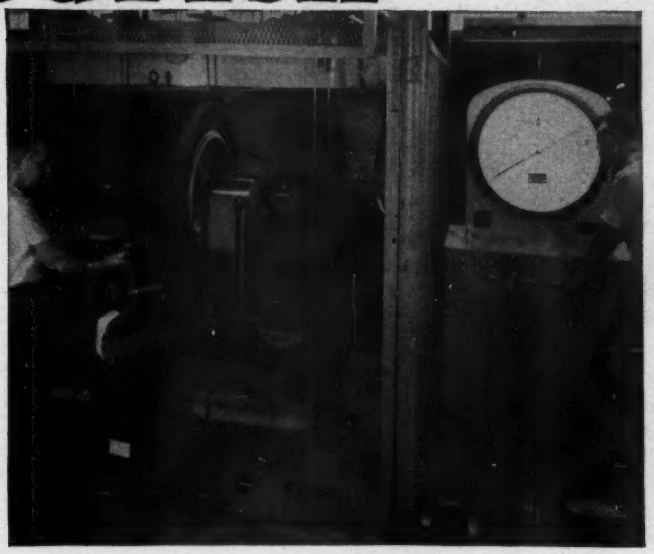
Arma's self-contained integrated navigation and fire control systems will contribute materially to the operational effectiveness and all-weather capabilities of our nation's latest tactical fighter bombers.
Arma . . . Brooklyn, N. Y.; Garden City, N. Y.
A division of American Bosch Arma Corporation.

ARMA ADVANCED ELECTRONICS FOR CONTROL

ENGINEERS—write or visit Arma for complete information on challenging opportunities in our engineering division.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER





How to land a bomber in a phone booth

BEFORE B. F. Goodrich engineers devised and built the computer in the upper left hand picture, testing a new brake design was a time-consuming process. Laboratory tests of the finished product—sometimes even actual flight tests—had to be made before basic design specifications could be confirmed or modified. But now BFG design engineers have a short-cut. An electronic analog, almost small enough to fit in a telephone booth, simulates a landing and gives preliminary data—in minutes! BFG engineers correct and refine brake design data in the earliest stages, avoid "blind alley" tests that could waste weeks or months.

How do you benefit? We give you faster delivery by speeding up qualification of our brakes. We give you better braking assemblies because we can quickly confirm new engineering and design ideas. And you further benefit by actual dynamometer tests which verify the analog's electronic fortune telling.

At top right you see a BFG forged magnesium wheel passing a terrific static overload test. Strains applied by the 500,000 lb. loading machines are being measured by resistance strain gages and recorded on the oscillograph.

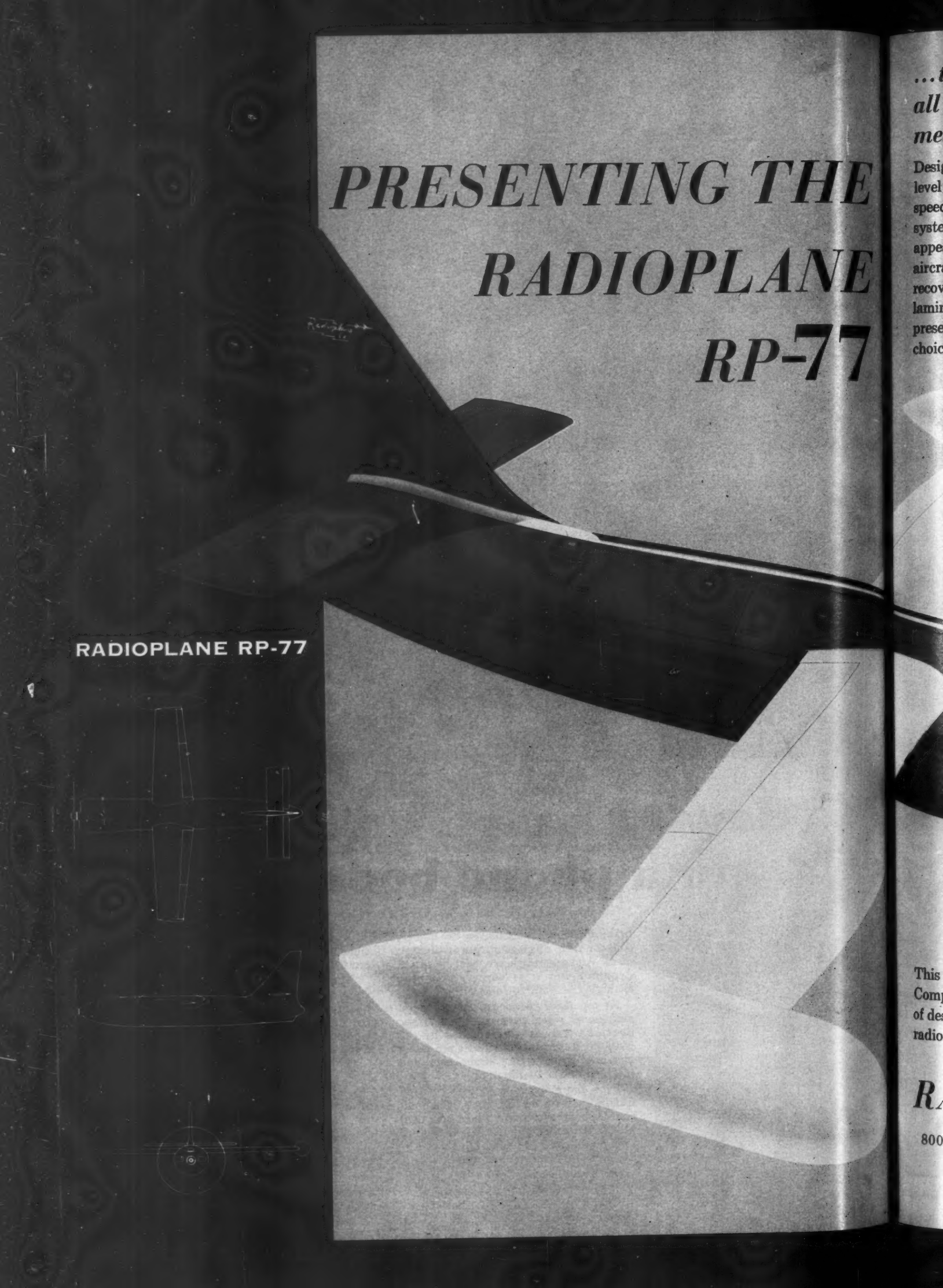
Even more dynamic is the "refused take-off" test on the 250 mph dynamometer. A bomber's *single* wheel and dual brake combination must absorb more than 30,000,000 ft.-lbs. of kinetic energy —as much force as is generated by stopping approximately 65 automobiles going 60 mph—but the BFG brakes bring the plane to a standstill in the specified landing time which assures a safe stopping distance. The wheel is undamaged.

The application of BFG knowledge and experience in research, testing, and quality control, assure you of getting the finest wheels and brakes. *The B. F. Goodrich Company, Tire and Equipment Div., Aeronautical Sales, Akron, Ohio.*

B.F.Goodrich
AVIATION PRODUCTS

Tires, wheels, brakes • De-Icers • Heated rubber • Fuel cells • Avtrim • Pressure Sealing Zippers • Inflatable seals • Rivnuts • Hose, accessories

PRESENTING THE RADIOPLANE RP-77



RADIOPLANE RP-77

...the new target drone which exceeds all military requirements in the medium performance class

Designed for performance in the 280- to 365-knot class, from sea level to high altitudes, the RP-77, the nation's newest medium speed drone is ready for immediate flight test. A proven control system assures successful out-of-sight missions, while its radar appearance makes it an ideal simulator of many contemporary aircraft. Capable of ground or air launch, completely recoverable by parachute, and constructed of rugged fiberglass laminate, the RP-77 has a much greater payload capacity than present operational target aircraft. It can be made available with a choice of three types of power plants.

This newest star on the drone horizon, developed with Radioplane Company funds, is tough, simple and economical—fundamentals of design at Radioplane, which has produced over 40,000 dependable radio-controlled target drones for the United States Military Services.

RADIOPLANE COMPANY

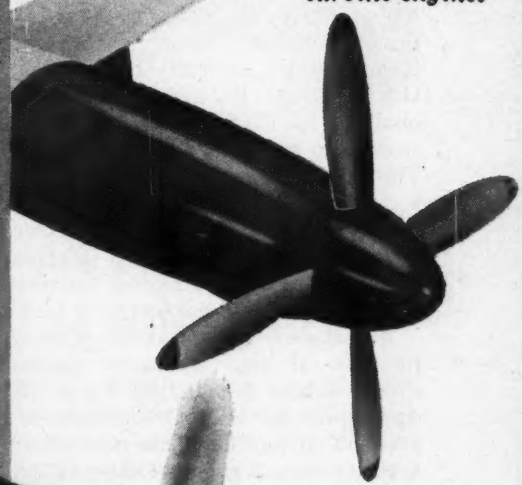
8000 WOODLEY AVENUE, VAN NUYS, CALIFORNIA

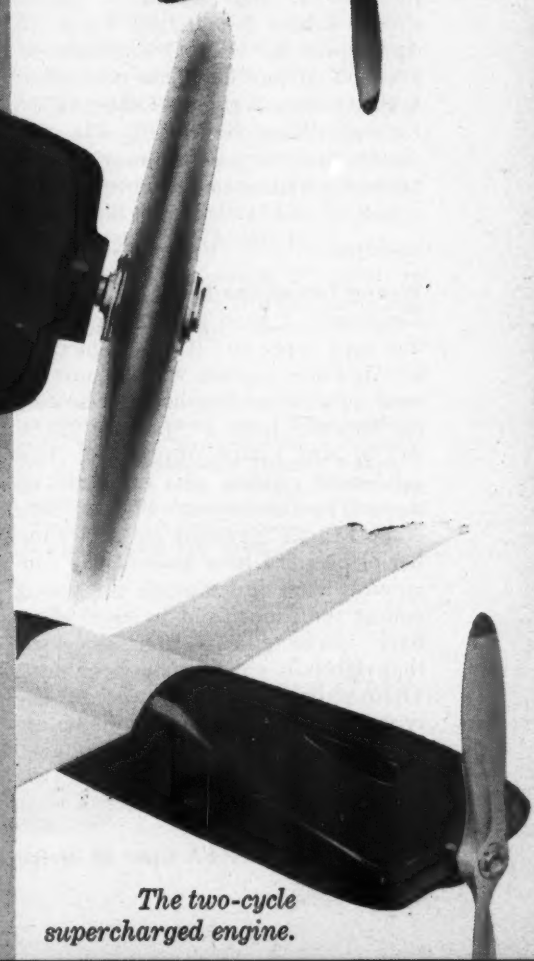
A Subsidiary of Northrop Aircraft, Inc.

THE RP-77 IS AVAILABLE WITH A CHOICE OF THREE TYPES OF POWER PLANTS.

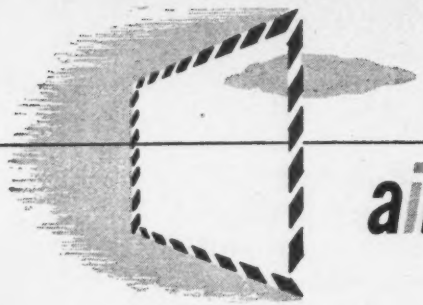
The four-cycle supercharged engine.

The turboprop free turbine engine.





The two-cycle supercharged engine.



air mail

Armament Center Jobs

Gentlemen: The Air Force Armament Center at Eglin AFB, Fla., is, at present, continuing a rapid rate of expansion. The need for qualified engineers and scientists in the various fields listed below is one vital to the interests of the country.

The Armament Center has recently been given the responsibility for the development of aerial munitions, including guns, bombs, rockets, fuzes, guided missile warheads, and related equipment, exclusive of nuclear weapons. Positions in fields covered by this responsibility have now become open, and are currently being filled. Our openings lie mainly for those qualified for Civil Service grades between and including GS-5 and GS-14. The personnel most urgently needed are physicists, mechanical engineers, ballisticians, and especially electronic engineers. Applicants chosen in these grades may expect to receive between $3,670 and $10,320 annually.

Any readers interested in applying for jobs at the Armament Center should submit a standard Form 57, Application for Federal Employment, available at any first-class post office, to the Civilian Personnel Office, 3201st Air Base Wing, Eglin AFB, Fla. Any information they desire may be obtained by writing to the same address.

Lt. Col. Harry R. Beamer
Eglin AFB, Fla.

Wrong End of the Funnel

Gentlemen: I have just finished reading your reply to "It was signed by an Air Force captain whose name we were unable to decipher" ("Shooting the Breeze," page 23, January '56 issue of AIR FORCE Magazine). This celebrated captain who mustered up the gall to address your office as "Dear Navy League" reminds me of a number of people I have known who consistently view life through the wrong end of the funnel and in some effect have "protected" us from the facts that rightfully should have been ours. These narrow-minded people are the type one would find peering the wrong way through a pair of binoculars, and, in various other applications of the same ideology, apply this act to their way of life, etc.

I have been in AFA since its inception, and I'm sure others like me wholeheartedly agree with AFA policy as regards free exercise of the advertisers' rights, even beyond your explanation concerning naval air ads. I have a modest income and therefore must limit literature purchases to those items which afford the greatest scope of informative reading, and I cannot indulge in purchases of items concerned with keeping the blinders on regardless of the field of fact. My judgment in selecting and continuing purchases of AIR FORCE has not been proven erroneous, thanks to you. Keep up the pace and keep us informed—even if it involves the Martian Navy, I want to be in on the know.

Frederick W. Hughes
Chicago, Ill.

Here's Another Idea

Gentlemen: In the "Jet Blast" section of your January issue of a great magazine, Maj. Luke Warm had some complaints about Efficiency Reports. I must disagree with the Major because in the cases he cites there was some delinquency either on the part of the individual rated or one of his subordinates. I know of several cases where the only defect was in that the superior's wife did not like the individual or his wife. This sounds like sour grapes, but the boys who were RIFed back in '53 will back me up.

I don't think Luke has the answer with his Review Board. I can't picture anyone trying to get any satisfaction by airing their troubles at an open hearing. Can you picture a Reservist trying it?

I think a better solution is in the machine age. Some of the better civilian brains working for the Air Force can devise a foolproof IBM-type of rating system that can prevent to a major degree some of the petty things that are put on Officer Effectiveness Report forms.

I wonder if Major Warm heard about the squadron commander who was practically lifted out of his job because he could not meet his fund drive quota as published in the base newspaper? The poor fool did not set up a collection line at the pay table, and tried to hedge out of it by quoting a certain AFR which prohibited these things.

Major, USAF

Million or Billion?

Gentlemen: In the excellent article about the budget in your February issue ("The Next Move Is Up to Congress"), you say the final figure of $16.518 billion included a last-minute increase for procurement of "half a million dollars." I wonder if this shouldn't have read "half a billion"? These days, half a million, or $500,000, doesn't buy much.

Procurement Officer

● *Billion it should have been. That's what happens when we get bad about the mudget.—The Editors.*

Total Unification

Gentlemen: I would like to see as a sequel to Major de Seversky's article ("Obsolete Thinking," January '56), a study by some organizational genius outlining a plan for complete unification of all US armed forces. No more Army, Navy, Air Force, Marine Corps, Coast Guard, but *one* Armed Force, with perhaps lower echelon commands specializing in the various functions.

Unification, under this plan, would include even such things as the uniform we wear; and would outmode

(Continued on page 7)

AIR FORCE Magazine is published monthly by the Air Force Association. Printed in U.S.A. Re-entered as second class matter, December 11, 1947, at the post office at Dayton, Ohio, under the act of March 3, 1879. **EDITORIAL CORRESPONDENCE AND SUBSCRIPTION** should be addressed to Air Force Association, Mills Building, Washington 6, D. C. Telephone, Sterling 3-2305. Publisher assumes no responsibility for unsolicited material. **CHANGE OF ADDRESS:** Send old address *and* new address (with zone number, if any) to Mills Building, Washington 6, D. C. Allow six weeks for change of address. **SUBSCRIPTION RATES:** $4.00 per year, $5.00 per year foreign. Single copy, 35 cents. Association membership includes one-year subscription: $5.00 per year (Cadet, Service, and Associate membership also available). **ADVERTISING CORRESPONDENCE** should be addressed to Sanford A. Wolf, Advertising Director, 114 East 40th St., New York 16, N. Y. (MUrray Hill 9-3817). Midwest office: Urben Farley & Company, 120 S. LaSalle St., Chicago 3, Ill. (Financial 6-3074). West Coast office: Hugh K. Myers, Manager, 685 S. Carondelet St., Los Angeles, Calif. (DUnkirk 2-6858). **TRADEMARK** registered by the Air Force Association. Copyright 1956, by the Air Force Association. All rights reserved under Pan American Copyright Convention.

KEEPING AN EYE ON THE IONOSPHERE

The F layer, 175 miles up, is a lively region. Crackling with geomagnetic activity and auroral phenomena, it will receive intensive study during the International Geophysical Year.

During IGY, in a series of Arctic launchings, Aerojet-General Aerobees will be the eyes of science. The world's most widely used research sounding rocket, the Aerobee carries aloft a payload of delicate measuring devices and parachutes them safely back for study.

A free-flight vehicle stabilized by fixed fins, the Aerobee is not subject to the many electro-mechanical difficulties of controlled missiles. High reliability and low cost have made it a favorite Service research tool since 1947.

• Solid- and Liquid-Propellant Rockets for Assisted Takeoff and In-Flight Thrust Augmentation of Piloted Aircraft • Solid- and Liquid-Propellant Boosters and Prime Powerplants for Missiles • Thrust Reversers • Auxiliary Power Units and Gas Generators • Upper-Atmosphere Research Rockets • Underwater Propulsion Devices • Electronics and Guidance • Ordnance Rockets • Explosive Ordnance, Warheads, and Armament • Flame Throwers • Propellants and Propellant Chemicals • Primary Batteries • Pressure Vessels • Architect-Engineer Services • Rocket Test Facilities

Aerojet-General CORPORATION

A Subsidiary of
The General Tire & Rubber Company

THE GENERAL TIRE

AZUSA, CALIFORNIA
SACRAMENTO, CALIFORNIA

MORE POWER FOR AIR POWER

OMAR

breaking through problems of supersonic propulsion

THE WEAPONS SYSTEMS CONCEPT IN ACTION

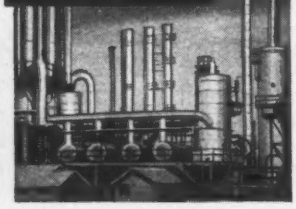
Joining skill and experience in research, development, and production of supersonic powerplants and fuels, Marquardt Aircraft, Olin Mathieson Chemical, and Reaction Motors demonstrate the weapons systems concept in operation. Coordinated through the OMAR Joint Technical Committee, these recognized leaders in the fields of rocket and ramjet engine design, chemical research, metallurgy and fuels are adding new team impetus to the advancement of supersonic aircraft and missile propulsion.

Engineers, chemists, physicists, production and tool specialists . . . a wide variety of fascinating careers await you on this weapons systems team. For information write OMAR Employment Officer at the company nearest you.

RAMJETS

Marquardt Aircraft Company
Van Nuys, California

PROPELLANTS



Olin Mathieson Chemical Corporation
New York, New York

ROCKETS

Reaction Motors, Inc.
Denville, New Jersey

MARQUARDT AIRCRAFT
OLIN MATHIESON CHEMICAL
REACTION MOTORS

OMAR

the concept of separate service academies.

Present thinking is always colored by experiences, traditions, and loyalties of the "glorious past." It is asking a lot to expect a man who has helped to mold that past to admit now that his specialty *is* a thing of the past. Can we not forget our differences and combine our talents—a fresh start in a new and *single* vehicle?

Professor of Air Science

Son's Photo

Gentlemen: The November '55 issue of AIR FORCE has a picture on page 36 in the middle of the article about the survival course at Stead Air Force Base. My son, Maj. Raymond P. Britton, is the central figure shown in light khaki shirt passing a food receptacle. I should like very much to secure a print or copy of this picture.

For your information, my son did sixty-five combat missions as pilot of a B-26 during World War II, over Italy, France, and Germany. He joined the Air Reserve on release from active duty in 1946, was called back in May of 1951, and has decided to stay as long as the Air Force will keep him. He did thirty-six more combat missions out of Japan as pilot of an RB-50, and is currently assigned to Wichita, Kan., undergoing training in RB-47 jet bombers.

Lt. Col. Alton C. Britton, USAR
Battle Creek, Mich.

• *The picture is on its way. Thanks for your letter—we think our readers are always interested in more information about people who appear in our unidentified photos.—The Editors.*

Correction Please

Gentlemen: In the article entitled "Art of Common-Sense Management," in the "Jet Blasts" department (January '56), Lt. Col. Jasper L. Godwin, Jr., states, quite erroneously:

"North American Aviation has faced the problem of rapid personnel turnover for years in its Columbus, Ohio, plant."

Personnel turnover rates at the Columbus Division of North American Aviation, Inc., during the five-year period this division has been in operation, have been lower than the turnover rates for all manufacturing industries during the same period.

Separation rates at the Columbus Division have been comparable to those of the aircraft industry. For example: in 1952 and 1953 the Columbus Division rates ran eight-tenths of one percent and one-half of one percent higher than the aircraft industry; but in 1954 and 1955 they ran one-half, and one and one-tenth percent lower, respectively.

Colonel Godwin compounds his error when he says that the situation which he cites, incorrectly, has existed "for years." The implication he leaves is that here is a problem which has existed for a great many years.

Furthermore, Colonel Godwin writes that the solution to this problem, which actually did not exist, "has been to insist upon precise, formalized procedures for the accomplishment of every single job regardless of its simplicity or complexity."

The fact of the matter is this: A job evaluation program, with rate ranges and job descriptions, was imported from other company installations by the Columbus Division when it began operating in December 1950. Again, it is a matter of record that this program had been in effect at other North American Aviation installations for many years before.

W. R. Hilbrink
North American Aviation, Inc.
Columbus, Ohio

Principles of Good Management

Gentlemen: It was with a great deal of interest that I read your "Jet Blast"

(Continued on following page)

Single Omni/ILS is Fine . . .

Dual is Better . . . Now the

ARC Course Director

gives new Ease, Precision and Safety in Navigation

You've experienced the advantage of omni/ILS navigation and seen how DUAL installations make flying twice as simple. Now ARC offers its new COURSE DIRECTOR to give you a real "hand-up."

Working with your omni/ILS equipment—single or dual—the COURSE DIRECTOR supplies *automatically computed* steering information for all EN ROUTE, INTERCEPTION, HOLDING, INBOUND AND OUTBOUND ILS APPROACH PROBLEMS. This precise steering data is clearly presented, and there is automatic compensation for cross-wind. Heart of the instrumentation is an electronic computer which performs all your calculations. The slaved gyro provides stabilized heading data. You simply set a course and *steer* to keep the vertical needle centered on your regular Cross-Pointer Meter.

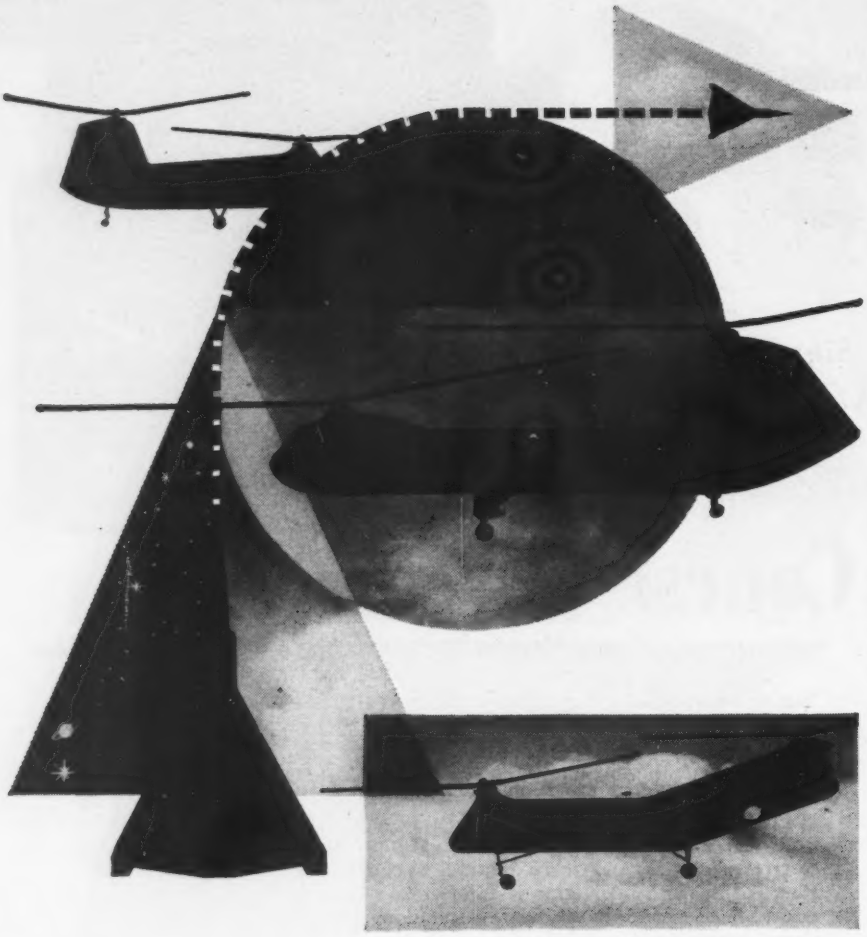
Teamed with DUAL ARC Type 15D Navigational Receiving equipment, (or other standard VHF Navigational equipment), the COURSE DIRECTOR takes 90% of the work out of flying . . . offers a new high in ease, precision, and safety. See your nearest ARC Dealer or write now for detailed illustrated literature.

Reliable, lightweight, CAA Certificated

Omni Receivers • 900-2100 Mc Signal Generators • UHF and VHF Receivers and Transmitters • 8-Watt Audio Amplifiers • 10-Channel Isolation Amplifiers • LF Receivers and Loop Direction Finders • CD-1 Course Directors

Aircraft Radio Corporation BOONTON, NEW JERSEY

Dependable Airborne Electronic Equipment Since 1928



NEW SHAPES of things to come from Piasecki ...

Startling new flight concepts are taking shape on the drawing boards—in the test cells—of the Piasecki Research and Development Division.

New airfoils, new control devices, new lift configurations—these are the building blocks of future Piasecki developments.

Looking to the immediate future, progress has already been made in Vertical Takeoff aircraft. New and improved helicopter designs—projections of Piasecki's long research and engineering experience in high performance helicopter design and production—are nearing the flight stage.

Today, many different models of Piasecki helicopters are flying for the three Armed Services . . . everywhere . . . doing dozens of difficult jobs. Tomorrow, the shape of Piasecki aircraft to come will be a vital part of our Defense picture, our air transport scene.

In the future, as today, Piasecki will design and build aircraft for performance, for versatility—*for the toughest jobs.*

ENGINEERS NEEDED FOR: DESIGN • AERODYNAMICS
TESTING • STRESS ANALYSIS • AIRFRAMES

Send resume to John Tannone, Jr., Employment Representative

Piasecki HELICOPTER CORP.
MORTON, PENNSYLVANIA

AIR MAIL—CONTINUED

which appeared in the January '56 issue of AIR FORCE Magazine. I heartily agree with Colonel Godwin's contention that the application of common-sense management principles is essential to the operation of a large and complex organization.

Maj. Gen. R. L. Maxwell
USA (Ret.)
Am. Machine & Foundry Co.
New York, N. Y.

Gentlemen: Recently, I became a member of the Air Force Association, and one of the many rewards I receive is your AIR FORCE Magazine.

In each issue I read with great interest the "Jet Blasts" section. I feel that every person who reads your magazine reads this section. Commanders and potential commanders should read it, if they have the least bit of initiative to improve the Air Force—and themselves. For example, in the January '56 issue, "Art of Common-Sense Management," by Lt. Col. Jasper L. Godwin, Jr., there is information that can and should be used by every element or unit in the Air Force. I was so impressed with his suggestions that I typed out the list for future reference.

Cadet Lt. Col. Jack L. Wilson
University of North Carolina
Chapel Hill, N. C.

Guess He Was Just Lucky

Gentlemen: The account of a flight over the old air-mail route by Samuel Taylor Moore in your January issue was very entertaining and narrated well the trials and tribulations of cross-country flying of that era.

Mr. Moore, on page 115, states "Thank heaven, the brakes worked."—He should thank heaven he *had* brakes, as I never saw brakes on a D-H, or on any other airplane in 1924. Perhaps they did not issue them to second lieutenants. Maybe my friend McDuffie had a pull.

Col. H. T. McCormick
USAF, (Ret.)
Reseda, Calif.

World's Oldest Pilot

Gentlemen: I was thrilled over the space you gave to the November AFA affair here in Riverside. It was very interesting and stimulating. I have sent my copy of the January issue to Mr. Montee, the ninety-three-year-old pilot whose picture appeared with the other Riverside pictures. Mr. Montee accompanied me to the banquet that night. The CAA says he is the oldest active licensed pilot in the world.

Nellie Korf
Riverside, Calif.

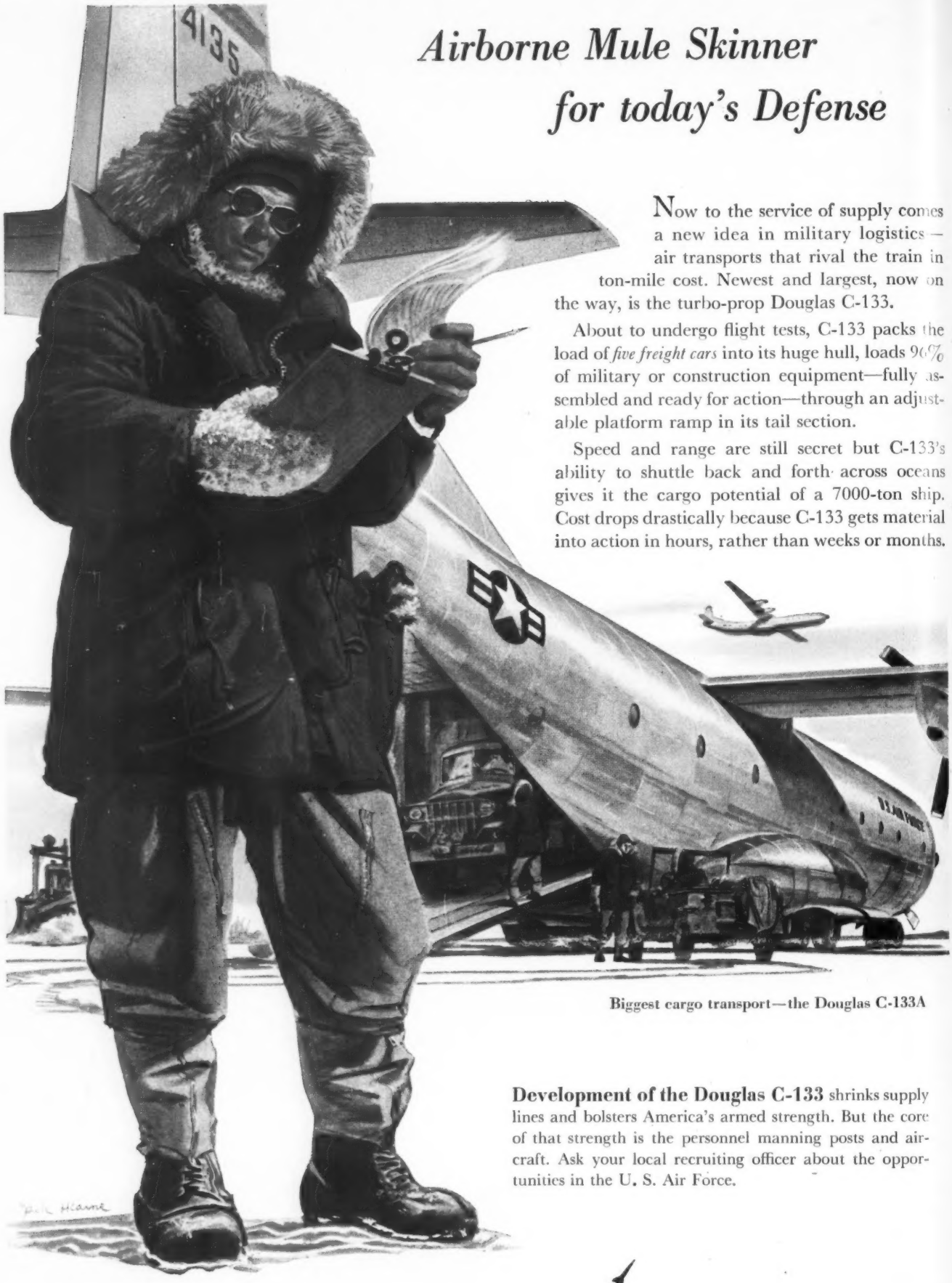
FORECAST: SECURITY—Northrop's dramatic development of long-range, all-weather interceptor aircraft is an important factor in our country's program for protection in the air. As a pioneer in this and other fields, Northrop has initiated many achievements that contribute to national safety. These accomplishments include the Northrop Scorpion F-89 interceptors now stationed at the U.S. Air Force's most strategic bases, ready to rise and destroy hostile aircraft under "impossible" weather conditions. Also included are Radioplane Company's versatile drones and missiles, and Northrop's unmanned Snark SM-62 intercontinental A-bomb carriers. New weapon systems of tomorrow are now being developed by Northrop engineers and scientists. Economical output and prompt delivery are assured by Northrop's balanced production force which capably matches the company's years-ahead vision and planning.

NORTHROP

NORTHROP AIRCRAFT, INC. • HAWTHORNE, CALIFORNIA

Pioneers in All Weather and Pilotless Flight

Airborne Mule Skinner for today's Defense



Now to the service of supply comes a new idea in military logistics — air transports that rival the train in ton-mile cost. Newest and largest, now on the way, is the turbo-prop Douglas C-133.

About to undergo flight tests, C-133 packs the load of *five freight cars* into its huge hull, loads 96% of military or construction equipment—fully assembled and ready for action—through an adjustable platform ramp in its tail section.

Speed and range are still secret but C-133's ability to shuttle back and forth across oceans gives it the cargo potential of a 7000-ton ship. Cost drops drastically because C-133 gets material into action in hours, rather than weeks or months.

Biggest cargo transport—the Douglas C-133A

Development of the Douglas C-133 shrinks supply lines and bolsters America's armed strength. But the core of that strength is the personnel manning posts and aircraft. Ask your local recruiting officer about the opportunities in the U. S. Air Force.

Depend on *DOUGLAS* **First in Aviation**

wing tips

By Wilfred Owen

Last year the scheduled airlines of the United States carried nearly 7,000,000 more passengers than they did in 1954. The total number of persons traveling by air was nearly 42,000,000, including both domestic and international flights.

• • •

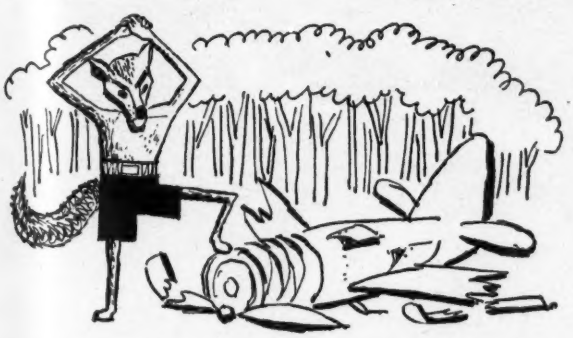
The total number of customers for all airlines in the world during 1955 was 70,000,000. This was 11,000,000 more than the previous year.

• • •

The International Air Transport Association thinks the 100,000,000 passenger mark will be reached by 1957.

• • •

A low-flying plane was knocked out of the sky this winter by a timber wolf. When the plane buzzed the



animal, the wolf leaped up, hit a ski, and downed the craft.

• • •

You can fly a horse and groom from New York to London for $1,200. A flying horse can be insured for $100,000 by payment of an additional $750.

• • •

Last year 500 aviation officials from thirty-nine countries visited US air facilities under CAA guidance. The United States had twenty technical assistance missions operating in foreign countries.

• • •

A total of 2,500 air transport pilot certificates were issued in 1955. During the same period 16,000 persons obtained private pilot certificates.

• • •

Of the 350,000 active pilots in the United States, 76,000 are over forty years old, and 2,654 are over sixty. There are 10,183 pilots sixteen to nineteen years old.

• • •

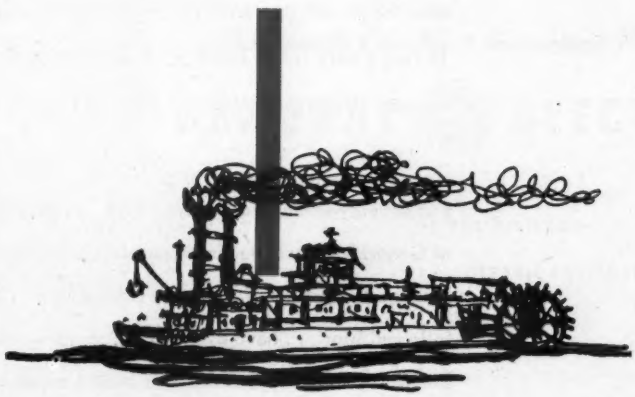
In Colorado Springs an Air Force amphibian search plane helped the police trail and trap a suspected extortionist. The victim's car, painted on top with luminous paint, was easily tailed from the air as it made a rendezvous to deliver $30,000.

• • •

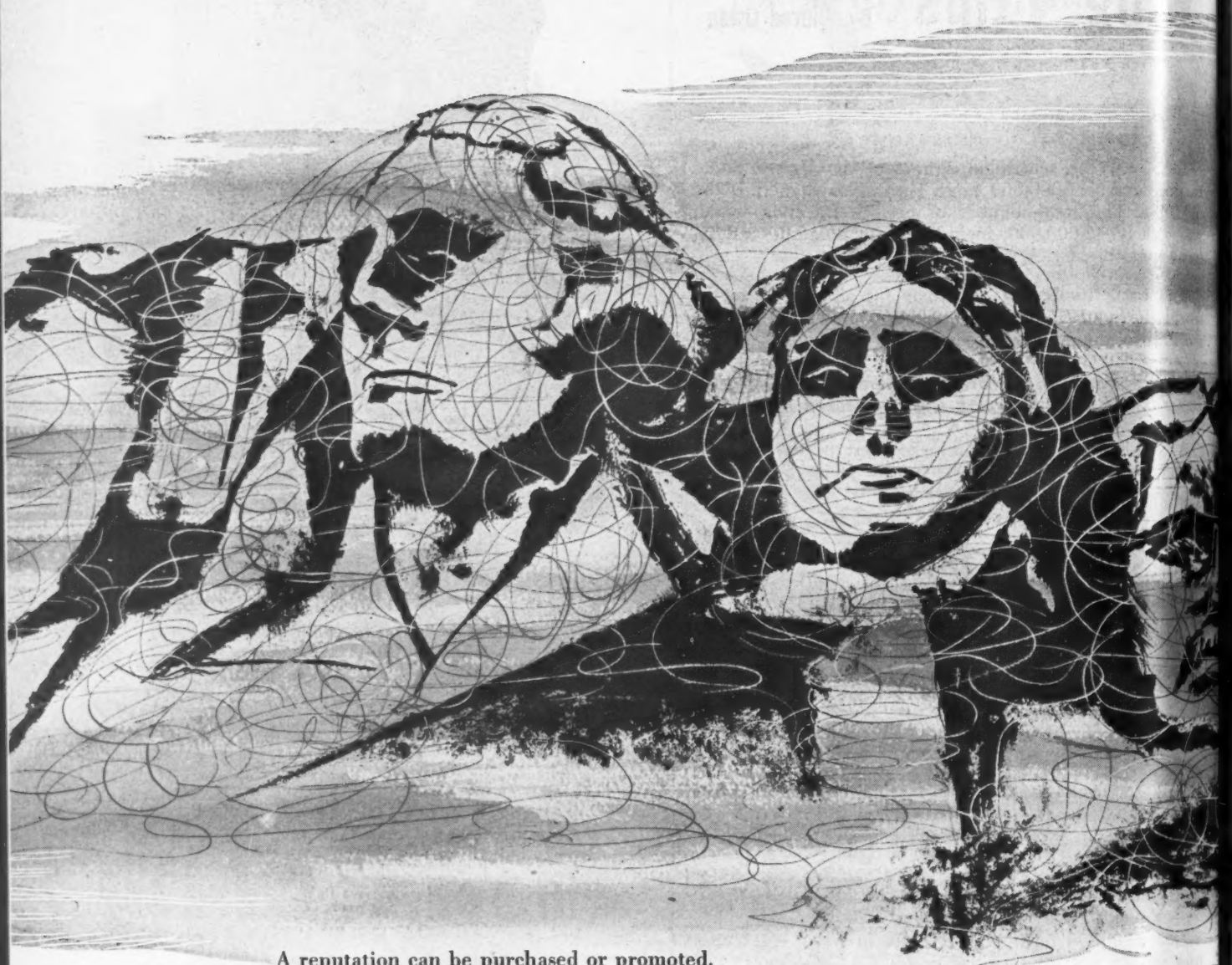
For US carriers the 1955 accident toll was one fatality per billion passenger miles. On US international flights more than 2,000,000,000 passenger miles were flown for each passenger fatality.

Will You Be There?

SEE PAGE 134



reputation seems...



A reputation can be purchased or promoted.
It may flower fleetingly . . . and as fleetingly disappear. Character is what we are . . .
and what we are evolves slowly and surely through the years.
If the years have been rich in achievement and in fine works . . .
we are that much *bigger* in a priceless and enduring sense.

For seventy-seven progressive years . . . through boom, bust, war and peace . . . the character of General Electric has been unfolding. New ideas and new developments . . . brought about through the genius of the great Steinmetz . . . and brilliant engineering minds which preceded and followed him . . . have been the outstanding characteristic of this company.

Today, what General Electric *is* makes us an accepted leader in the field of electrical and electronic manufacture. Indeed, ***Progress is our Most Important Product.***

..character is!

LMEED

with its scope of operation so vital to the continued well-being of the free world . . . and the established standards of other departments of General Electric . . . assumes its part in maintaining character. The company's great heritage is translated . . . and magnified, here, in traditional research, sound testing, skillful development, and highly competent workmanship.

Your LIGHT MILITARY ELECTRONIC EQUIPMENT needs can be trusted to no better minds and hands.

The Broad Divisions of LMEED Product Engineering are:

- BOMBER DEFENSE
- FIRE CONTROL RADAR
- SEARCH RADAR
- INDICATORS: DISPLAY
- COUNTERMEASURES
- NAVIGATION
- MISSILE CONTROL
- SUBMARINE DEFENSE
- COMMUNICATIONS
- FUZES

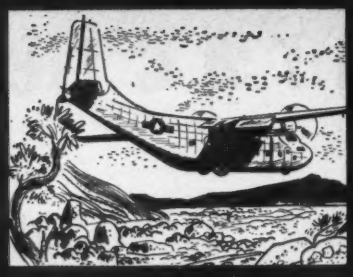
Progress Is Our Most Important Product

GENERAL ELECTRIC

LIGHT MILITARY ELECTRONIC EQUIPMENT DEPARTMENT

FRENCH ROAD, UTICA, NEW YORK

BIG LOAD • BIG LIFT
BIG PERFORMANCE
ARE BUILT INTO
FAIRCHILD C-123



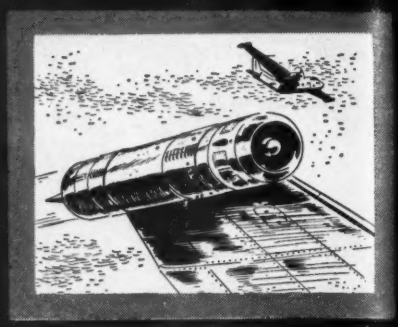
Lands or takes off in less than 10 times its own length. The Fairchild C-123 operates on any terrain with only 600 feet of field space.

Maximum load-carrying capacity and workhorse durability are just two of the many reasons why the Fairchild C-123 Assault Transport is ideally suited to tough jobs in all combat airlift operations.

Equipped with Fairchild J44 turbojets on each wing-tip, the C-123 is provided with a power package of 2,000 lbs. extra thrust to meet any critical take-off or flight requirement.

In front line operations, on any terrain, under the most difficult conditions, the Fairchild C-123 gives *big load, big lift,* and *big performance* where and when utility and logistics support is needed.

A Division of Fairchild Engine and Airplane Corporation.



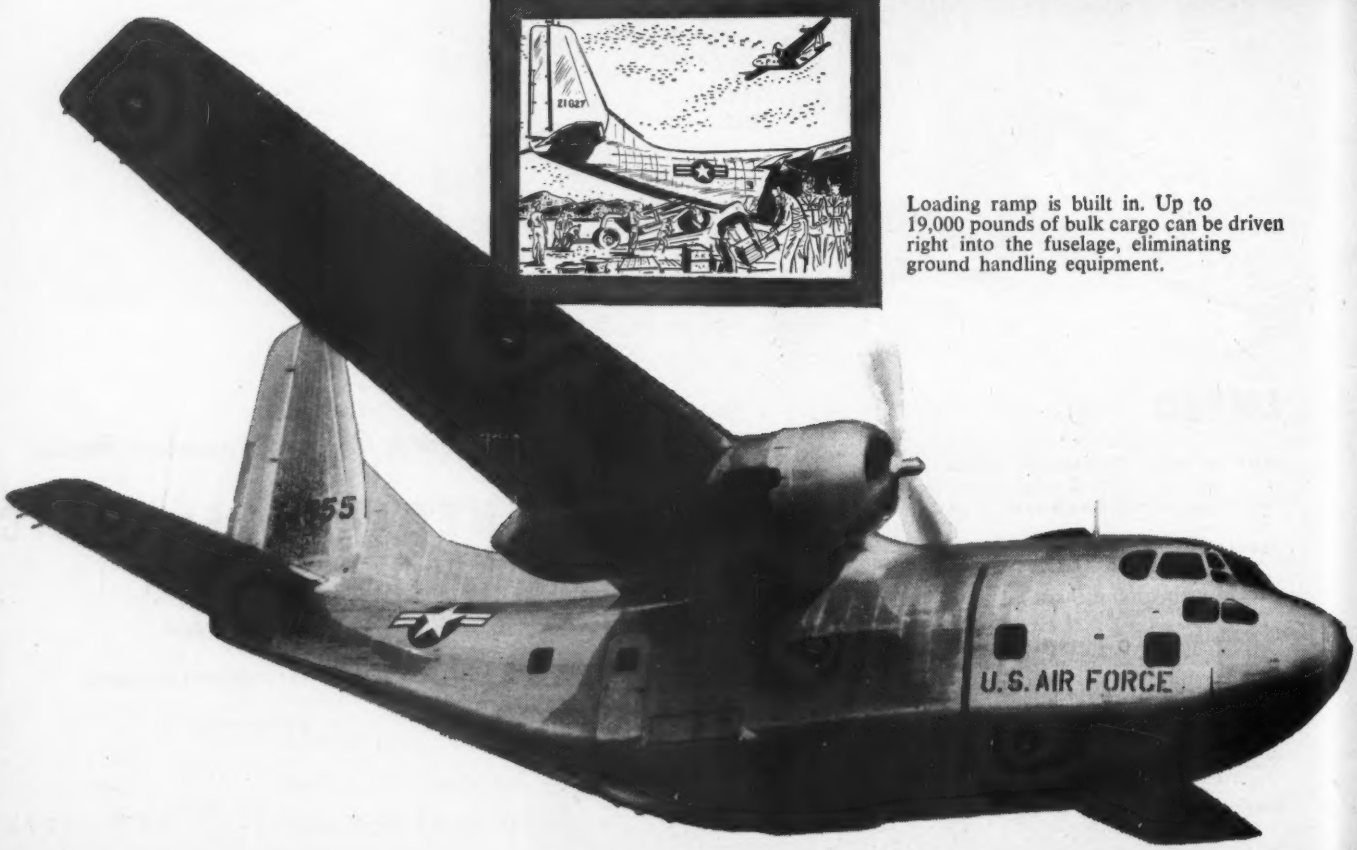
Fairchild J44 turbojet engines give added power thrust to the C-123, providing an extra margin of safety for any emergency condition.

FAIRCHILD

AIRCRAFT DIVISION • HAGERSTOWN, MARYLAND

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

Loading ramp is built in. Up to 19,000 pounds of bulk cargo can be driven right into the fuselage, eliminating ground handling equipment.



INDEX TO ADVERTISERS

Adel Precision Products Div., General Metals Corp. 98
Admiral Corp. 137
Aerojet-General Corp. 5
Aeroproducts Operations, Allison Div., General Motors Corp. 122
Aircraft Radio Corp. 7
AiResearch Manufacturing Co., Div. Garrett Corp. 140
American Airlines, Inc. 150
Arma Div., American Bosch Arma Corp. ..... Cover 2
Autonetics, a Division of North American Aviation, Inc. 37
AVCO Defense & Industrial Products .. 27
Avro Aircraft, Ltd. 28

Bendix Aviation Corp. 38
Beech Aircraft Corp. 54
Bendix Products Div., Bendix Aviation Corp. ..... Cover 3
Blythe Aircraft Corp. 151
Boeing Airplane Co. 22
Burroughs Corp. 50

Canadair, Ltd. 101
Cessna Aircraft Co. 105
Chance Vought Aircraft, Inc. 106
Chandler-Evans, Div. of Pratt & Whitney Co., Inc. 117
Cline Electric Manufacturing Co. 93
Collins Radio Co., Inc. 121
Consolidated Diesel Electric Corp. 138
Continental Aviation & Engineering Corp. 36
Convair, a Div. of General Dynamics Corp. ..... Cover 4
Curtiss-Wright Corp. 110

Delco Radio, Div. of General Motors Corp. 143
Douglas Aircraft Co., Inc. 10
Du Mont, Allen B. Laboratories, Inc., Institutional Div. 146

Eclipse-Pioneer Div., Bendix Aviation Corp. 53

Fairchild Engine & Airplane Corp., Aircraft Div. 14
Fairchild Engine & Airplane Corp., Stratos Div. 42
Federal Telephone & Radio Co., Div., International Tel. & Tel. Corp. 89
Fenwal, Inc. 148
Frick-Gallagher Manufacturing Co. 23

General Electric Company, AGT Div. ..... 90, 91 and 147
General Electric Co., Aviation & Defense Industries ..... 20 and 21
General Electric Co. LMEE Div. 12 and 13
General Mills, Inc., Mechanical Div. .. 126
Giannini & Co., G. M. Inc. 132
Goodrich, B. F. Co. 1

International Radiant Corp. 139

Jack & Heintz, Inc. 24

Kearfott Co., Inc. 130

Lear, Inc. 47
Link, Inc. 34
Lockheed Aircraft Corp. 31

Marquardt Aircraft Co. 149
Martin, Glenn L. Co., The 85

Northrop Aircraft, Inc. 9

Olin Mathieson Chemical Corp. (OMAR) 6
Orenda Engines Limited 125

Philco Corp., G & I Div. 18
Piasecki Helicopter Corp. 8
Pratt & Whitney Aircraft Div., United Aircraft Corp. ..... 32 and 33

RCA Engineering Products Div., Radio Corp. of America 94
RCA Tube Div., Radio Corp. of America 102
Radioplane Co., Sub. of Northrop Aircraft, Inc. ..... 2 and 3
Raytheon Manufacturing Co. 109
Reaction Motors, Inc. 113
Republic Aviation Corp. 17
Rheem Manufacturing Co., Government Products Div. 25

Scintilla Div., Bendix Aviation Corp. .. 86
Sikorsky Aircraft Div., United Aircraft Corp. ..... 40 and 41
Solar Aircraft Co. 118
Southwest Airmotive Co. 127
Stromberg-Carlson Co. 97
Stroukoff Aircraft Corp. 136

United Air Lines, Inc. 139
US Air Force 144

Vickers Inc., Div. of Sperry Rand Corp. 128

Waterman Products Co., Inc. 39

AIR FORCE

THE MAGAZINE OF AMERICAN AIRPOWER

Volume 39, No. 3 • March 1956

FEATURES

We Are Beating Ourselves—Right in the Pentagon
JOHN F. LOOSBROCK 43

Never Underestimate Your Crew Chief
LT. COL. KENNETH E. KAY, USAF 141

THE JET AGE — *A Special Report*

Setting the Stage
GILL ROBB WILSON 48

Military Requirements in the Jet Age
GEN. EARLE E. PARTRIDGE, USAF 51

Commercial Aviation's Future
MILTON W. ARNOLD 57

AF Reserve—Problems and Requirements
MAJ. GEN. WILLIAM E. HALL, USAF 59

The Air Guard and the Community
MAJ. GEN. WINSTON P. WILSON, USAF 61

What's Ahead for Business Aviation?
HENRY W. BOGGESS 64

The Air Force in the Jet Age
GEN. NATHAN F. TWINING, USAF 67

What Are We Doing About the Noise Problem? A FORUM 70

Flying Safety—The Military View
BRIG. GEN JOSEPH D. CALDARA, USAF 75

The Role of Civilian Airports
ROBERT ALDRICH 77

Civilian Aeronautics in the Jet Age
CHARLES J. LOWEN, JR. 80

Military Air Traffic Control
MAJ. GEN. KENNETH P. BERGQUIST, USAF 83

Flying Safety—The Civilian View
JEROME LEDERER 88

Technological Developments in the Jet Age
DR. HUGH L. DRYDEN 96

Resources for Readiness-in-Being
THE HON. DONALD A. QUARLES 104

Air Traffic Control—Implications of SAGE
DR. GEORGE E. VALLEY, JR. 111

Controlling Traffic on Our Crowded Airways A FORUM 115

DEPARTMENTS

Air Mail 4
Wing Tips 11
Airpower in the News 16
Airman's Bookshelf 23
Shooting the Breeze 26
Jet Blasts 35
Tech Talk 129
AFA News 133

AIR FORCE MAGAZINE STAFF

JAMES H. STRAUBEL ..... *Editor and Publishing Director*
JOHN F. LOOSBROCK ..... *Managing Editor and Assistant Publisher*
RICHARD M. SKINNER ..... *Assistant Managing Editor*
LEE KLEIN ..... *Associate Editor*
ROBERT C. STROBELL ..... *Associate Editor*
JACK MACLEOD ..... *Art Director*
NELLIE M. LAW ..... *Editorial Assistant*
EDMUND F. HOGAN ..... *Reserve Affairs Editor*
GUS DUDA ..... *AFA News Editor*

•

SANFORD A. WOLF ..... *Advertising Director*
JANET LAHEY ..... *Advertising Production Manager*

AIRPOWER IN THE NEWS

■ **Missiles** were again very much in the news. **Sen. Stuart Symington,** (Dem-Mo.), appearing on the **NBC-TV** program **"Meet the Press,"** said "I don't 'believe' the Soviets are ahead of us in ballistic missiles—I state that **they are ahead of us in ballistic missiles."** He also said that the Russians have fired missiles that went **"hundreds of miles farther than anything this country has ever tested."** Senator Symington, first Secretary of the AF (in the Truman Administration), criticized the present Administration's policy with regard to missiles and said, "Every day we don't reverse our policy is a bad day for the Free World."

Earlier, another Senator, **Henry M. Jackson** of Washington, said there is "danger that the **Soviets may fire a 1,500-mile ballistic missile** before the end of this year." He called for "all-out work on critical projects today to avoid all-out war tomorrow," and said the **balance of world military power would swing to the Soviets** if they won "the critical race" for a long-range missile. He urged **appointment of a "full-time civilian administrator,** reporting directly to the Secretary of Defense and to the President," to give the whole missile set-up the "maximum effort of which this nation is capable."

On the heels of Jackson's speech to the Senate, **Defense Secretary Charles E. Wilson** announced that he planned to appoint just such a person. The new missiles "czar," according to Secretary Wilson, will have unusual powers and responsibilities. Wilson said this project had been on his mind for some time and emphasized that his department was already **"working quite effectively** in the missile field."

As a result of a basic policy disagreement (see page 43), **Trevor Gardner,** Assistant Secretary of the AF for Research and Development, **resigned in protest** over the way the R&D program is being run. In making his resignation known at a news conference Gardner said the main issue involved was **his failure to receive $200,000,000** more for acceleration of research and development, especially in missiles, that he believed necessary. However, one man who knows Gardner well but refused to be identified, said that his resignation was due to **"much more than the guided missiles program,"** and that "he is dismayed at what he considers **dangerous paring of money** for research on other weapons—particularly those that we could develop in the next couple of years, to have ready while we're still waiting for completion of the ballistic missile." Gardner joined the Eisenhower Administration in April 1953 as a special assistant to the Secretary of the AF for Research and Development. He was later appointed Assistant Secretary.

Giles J. Strickroth, Martin electronics engineer, has been named to receive the 1955 Lawrence Sperry Award by the Institute of Aeronautical Sciences. The 33-year-old engineer was directly responsible for development of the guidance system used on the Martin TM-61 Matador.

And, in a report to the President, the **National Advisory Committee for Aeronautics** said, "There is evidence to indicate that **our present position of leadership in the air has been challenged** by a potential enemy. To maintain at manageable cost, the necessary airpower of requisite quality demands continuous research to anticipate the requirements of tomorrow's weapons."

■ While US weapons experts were expressing alarm at the rate of Soviet technological progress in that field, there are indications that the Reds are not exactly standing still in application of nuclear energy for power. If the Russians are successful with their present plans, they will have atomic electricity plants with greater capacity than that estimated for the US and Britain combined by 1960. Russian plans call for completion of plants by 1960 with a total capacity of up to 2,500,000 kilowatts.

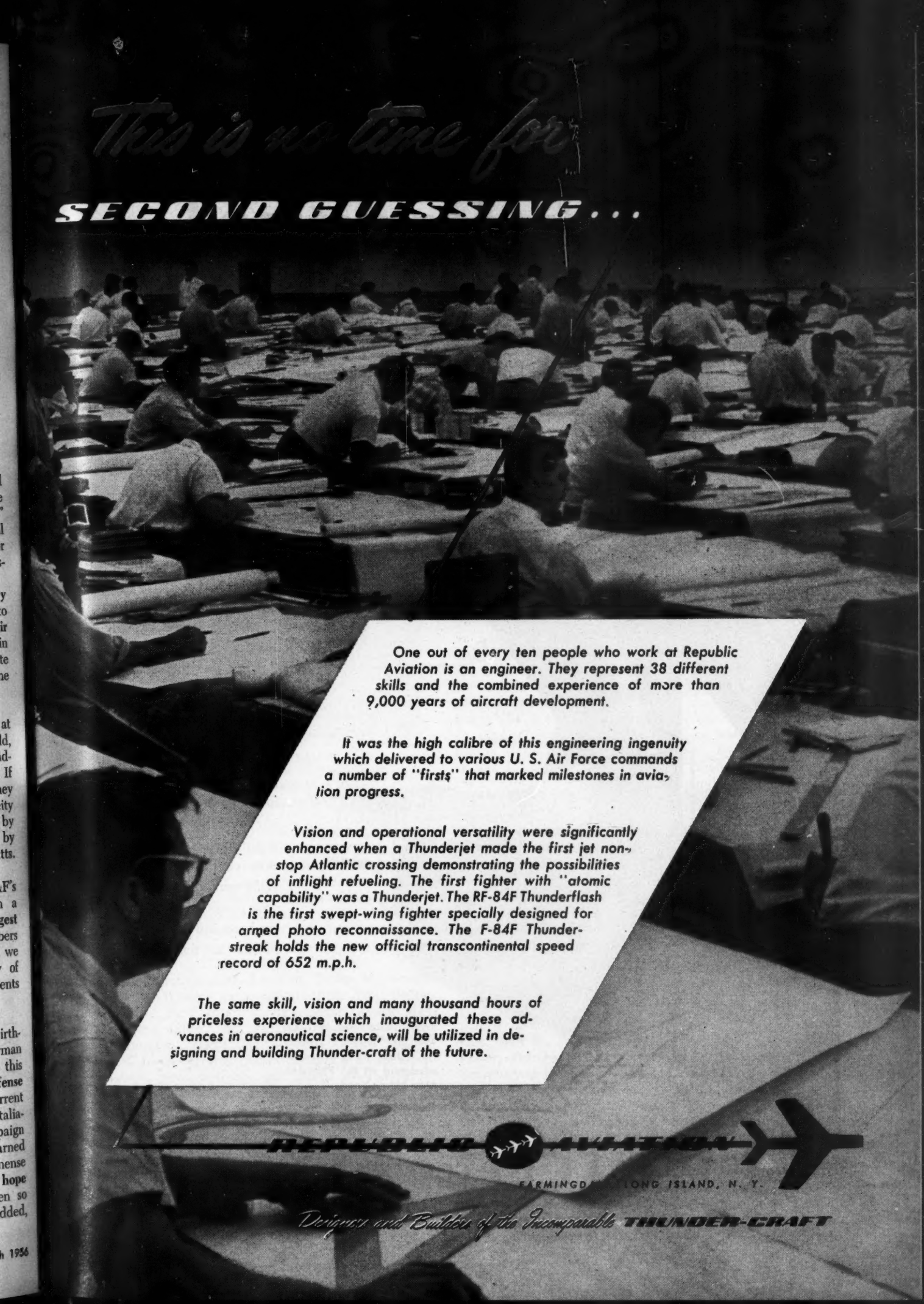
■ **Lt. Gen. Thomas S. Power,** commander of the AF's Air Research and Development Command, said in a speech in New York that the **Russians have the largest fighter defense force** in the world, and that their bombers "can be compared with the most advanced aircraft we possess." He said the US is still ahead in quality of weapons but warned that the Soviet Air Force "represents **a formidable threat** against this country."

■ At a luncheon of **Edison Pioneers** on the 109th birthday of **Thomas Alva Edison, John Jay Hopkins,** chairman and president of **General Dynamics Corp.,** said that this country needs a "binding concept of **an all-out defense** in the deepest sense of the phrase—the massive deterrent principle broadened from its posture of passive or retaliatory military strength to an active and continuing campaign on social, economic, and psychological fronts." He warned that Americans have failed to recognize the "immense psychological value" of **atomic energy as a symbol of hope** and peace and said "our adversaries have not been so reluctant. Should the Soviets actually deliver," he added,

(Continued on page 19)

Photo by John Eichler

At AFA Jet Age Conference, Arnold Air Society National Commander Gil Petrina, right, and Richard Berry invite AF Secretary Quarles to the Society's '56 Convention.



One out of every ten people who work at Republic Aviation is an engineer. They represent 38 different skills and the combined experience of more than 9,000 years of aircraft development.

It was the high calibre of this engineering ingenuity which delivered to various U. S. Air Force commands a number of "firsts" that marked milestones in aviation progress.

Vision and operational versatility were significantly enhanced when a Thunderjet made the first jet non-stop Atlantic crossing demonstrating the possibilities of inflight refueling. The first fighter with "atomic capability" was a Thunderjet. The RF-84F Thunderflash is the first swept-wing fighter specially designed for armed photo reconnaissance. The F-84F Thunderstreak holds the new official transcontinental speed record of 652 m.p.h.

The same skill, vision and many thousand hours of priceless experience which inaugurated these advances in aeronautical science, will be utilized in designing and building Thunder-craft of the future.

REPUBLIC AVIATION

FARMINGDALE, LONG ISLAND, N. Y.

Designers and Builders of the Incomparable THUNDER-CRAFT

"TERRIERS"
-ready for action!

U.S.S. Boston, the Navy's first guided-missile ship with its "Terriers" ready for action, as it was commissioned at the Philadelphia Navy Yard.

ONE OF THE MOST potent defense weapons now in use by our Navy is a supersonic, rocket-propelled, guided-missile called the "Terrier". Well named, the job of this electronically-controlled "watchdog" is to track down an enemy and put him out of action *before* he can strike.

Working in close cooperation with the Armed Services on this guided-missile, Philco research, engineering and production have made important contributions to its development. This has been particularly true in connection with the proximity fuse, the mechanism which extends the effective target range and enables the "Terrier" to demolish an aircraft the moment it gets in the *vicinity* of the marauder.

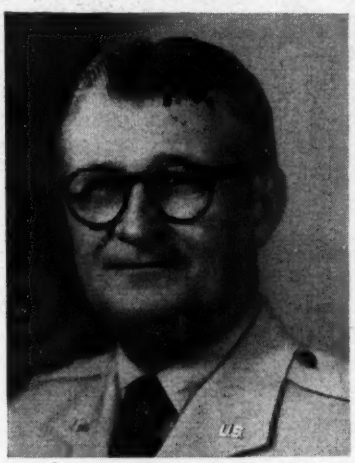
From the first sketch to the final, super-accurate mechanism, Philco pioneered and completed this assignment in cooperation with the Navy. Philco's world famous scientific knowledge and skill is a continuing factor in the development of tomorrow's defense for your protection . . . tomorrow's quality products for better peacetime living throughout the world.

PHILCO CORPORATION

"the forces of freedom may lose the economic war to the forces of aggression, and thus doom the world to Communist domination—without a bomb ever being dropped."

■ Defense Secretary **Charles E. Wilson** has recommended that a **health insurance plan** for dependents of servicemen be set up. Under the $76,000,000 program, the serviceman would pay thirty percent, about $4.50 a month, of the cost of the private health insurance, and the government would pay the rest. The dependents would then be cared for in civilian hospitals when facilities in military hospitals are not available. In a statement to the **House Armed Services Subcommittee,** Wilson said that servicemen **"cannot be expected to do their best** jobs in training or combat **if they** are worried about the health of their dependents."

■ Debate continues on the effect of **radioactive fall-out** on human health. At the **Northwestern University Alumni Fund lecture series, Dr. Willard F. Libby** said that "at present rates," the hazard to humans is insignificant. He warned, however, that there is "a very real hazard" within a few hundred miles of a surface nuclear explosion.



Maj. Gen. Lucas V. Beau, retired head of the Civil Air Patrol, has joined Consolidated Diesel Electric Corp. as Vice President in charge of foreign operations. General Beau is still an advisor to CAP.

■ The **Institute of Aeronautical Sciences 1955 Robert M. Losey** award for "outstanding contributions to the science of meteorology as applied to aeronautics," has been presented to Lt. Col. Robert C. Bundgaard, director of the AF's high-altitude weather research **"Project Black Sheep."** Colonel Bundgaard, based at Andrews AFB, Md., was cited for developing and improving **high-altitude weather forecasting techniques.**

■ The Army's research chief, **Lt. Gen. James M. Gavin,** told the **Aviation Writer's Association** that the Army needs air mobility and that armies geared to ground vehicles are "out of the window." Speaking at the **National Press Club** in Washington, he said that the **Army needed "highly sophisticated" troop-carrying planes** capable of flying close to the ground, moving troops and cargo around on a widespread battleground. He denied that the Army was trying to build up its own air force but said that it did need specialized, low-flying planes, and rockets and missiles for battlefield use.

■ **North American Aviation test pilot George Smith** is now back on the job and has flown an F-100 Super Sabre again *(see cut).* Smith attracted world-wide attention when he bailed out of his crippled F-100 above the speed of sound.

George Smith completes his first test flight since he became first to survive supersonic bail-out at low altitude.

■ AIRPOWER NOTES . . . The AF's **McDonnell F-101 Voodoo** has reportedly flown **faster than 1,000 mph. . . . Carswell AFB, Tex.,** has won SAC's **flying safety competition** for the second straight year. The base has been accident-free since December 1953. . . . **A MATS Boeing YC-97J Stratofreighter** (powered by four **Pratt & Whitney** T-34 turboprops) recently flew from Harmon AFB, Newfoundland, to Prestwick, Scotland—a distance of 2,350 miles—in six hours and three minutes. It was hailed in the British press as "the **fastest time for a propeller-driven aircraft."** . . . Two **SAC Republic F-84F Thunderstreaks** set a new record when they flew from Turner AFB, Ga., to Los Angeles and back in **eight hours and thirty-one minutes.** They refueled in flight several times, but did not land on the round trip. . . . French scientists have developed a **mobile radar "brain"** that is carried in two trucks and is said to be capable of directing a missile to an airplane fifty miles away. . . . The Navy's sixth ocean station radar ship, the **USS Scanner,** has been commissioned. It will be stationed off the Pacific coast as part of the Continental Air Defense Command under **Gen. Earle E. Partridge. . . . The Air Training Command** has cut its accident rate to **fifteen for every 100,000 flying hours.** This compares with a rate of twenty-nine for every 100,000 flying hours in 1951.

■ STAFF CHANGES—**Brig. Gen. James E. Roberts,** formerly Commander of the 3595th Combat Crew Training Wing, Nellis AFB, Nev., has been assigned to Hq., ATC, Scott AFB, Ill., as Inspector General. . . . **Maj. Gen. Lyman P. Whitten** has been relieved from duty as Commander, Middletown Air Materiel Area, Olmsted AFB, Penna., and has reported to the 1100th Personnel Processing Sqdn., Bolling AFB, Washington, D. C. His post was filled by **Maj. Gen. George R. Acheson,** formerly Commander, Alaskan Air Command, Seattle, Wash. . . . **Brig. Gen. Will W. White** retired from his position of Staff Director, Petroleum Logistics Division, Office of Assistant Secretary of Defense. . . . **Brig. Gen. Milton F. Summerfelt** has been relieved from duty with the Advance Planning Group, Europe, and assigned as Deputy Chief, Military Assistance Advisory Group, Germany. . . . **Maj. Gen. Byron E. Gates** retired from active duty at Chanute AFB, Ill. . . . On April 1, **Lt. Gen. Charles B. Stone** becomes Senior AF Member, Military Staff Command, United Nations, N. Y. . . . **Vice Adm. Alfred M. Pride** relieved **Vice Adm. Harold M. Martin** as commander of the Navy's Pacific Fleet air arm on February 1. Admiral Martin retired after thirty-seven years of service.—END

GENERAL ELECTRIC

ACTUAL SIZE

Photograph of the new General Electric 20 KVA hydraulic constant speed drive illustrates the small size of the 35-pound unit.

GENERAL ELECTRIC ANNOUNCES

New 20 KVA hydraulic constant speed drive ...weighs only 35 lbs

More and more, equipment on today's aircraft requires constant frequency electric power for optimum performance. To provide more reliable a-c power, General Electric has developed a new 20 KVA hydraulic constant speed drive with a weight of only 35 pounds. This 8000-rpm drive delivers a full 32 hp over an input speed range of 3900 to 7500 rpm. Steady state speed control of $\pm 1\%$ is provided by a built-in mechanical governor and speed control to $\pm 1/10\%$ can be obtained with an additional trimming device. Automatic paralleling can also be provided for two or more drives.

The compact, lightweight design of this 20 KVA drive permits pad mounting (with generator attached) on modern jet engines in most airframe applications.

This new 20 KVA drive has the same service-proven ball piston design as the General Electric 9 KVA drive now operating successfully on the Douglas A4D Skyhawk, currently in production for the U.S. Navy.

FOR FURTHER INFORMATION on how a G-E hydraulic constant speed drive can fit the electric requirements of your aircraft, contact your General Electric Aviation and Defense Industries Sales Office. Send coupon below for bulletins on G-E constant speed drives.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Mail coupon to: General Electric Company, Section E221–13, Schenectady 5, N. Y.

Please send me these bulletins on G-E hydraulic constant speed drives:

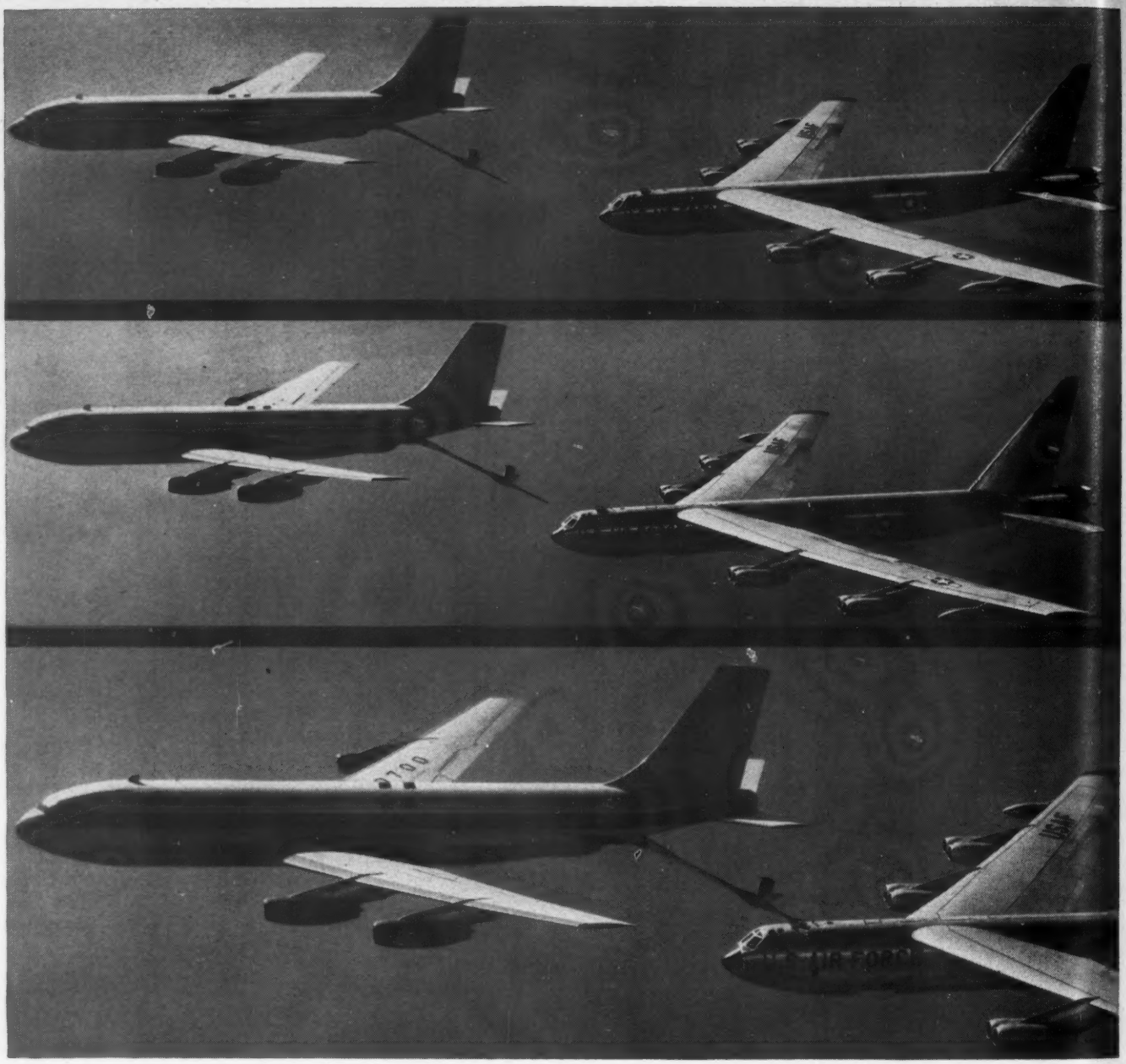
GEA-5979 G-E Hydraulic Constant Speed Drives
GET-2480 Theory of Operation
GED-2583 G-E 20 KVA Drive Template

Name.....

Position.....

Company.....

City.....State.....



Jet-to-jet refueling at 500 miles an hour

The Boeing jet tanker prototype is pictured above making a refueling contact with an eight-jet B-52 bomber.

This operation is part of an intensive test program in which every detail of America's first jet tanker, the Boeing KC-135, will be proved out well before the first production model rolls off the line.

For more than a year the Boeing prototype has been accumulating the kind of data obtainable only in actual flight. Resulting developments and design refinements have already been incorporated in the KC-135s now taking shape in Boeing's Renton, Washington, plant.

Besides proving out the airplane itself, the prototype makes it possible to test thoroughly the streamlined new Boeing Flying Boom, and all aspects of jet-to-jet refueling at speeds above 500 miles an hour, and altitudes over 35,000 feet. This means that when deliveries of the KC-135 to the Air Force begin, the airplane will be operationally proved. And it will be equipped with a flight-tested jet-speed refueling system.

The prototype has, during its hundreds of hours of grueling test flying, performed beyond expectations. This in part is a result of Boeing's unique experience designing and producing more large, multi-jet aircraft than any other company in the world. These include the B-52 eight-jet bomber, and more than 1200 six-jet B-47 medium bombers. In addition, Boeing pioneered the development of aerial refueling. It has built more than 600 Boeing KC-97s, the standard propeller-driven tanker of Strategic Air Command.

This is the unequalled background that gives assurance to the Air Force, and to the nation, that the Boeing KC-135 will be another outstanding, dependable aircraft.

BOEING

AIRMAN'S BOOKSHELF

FEW book writers today are able to translate the highly technical jargon of aeronautics into colorful layman's language. Lloyd Mallan is one who can. For this reason his *Men, Rockets and Space Rats* (Julian Messner, $5.75) becomes a landmark in air literature. It is a story of bold, dedicated men, human drama, tension and sacrifice; of strange-looking aircraft and weird equipment. It might be called a report on the first stages of conquest of outer space. But unlike most "space" books, this absorbing narrative is based on fact and includes eyewitness reports as well as interviews with the AF pioneers in rocket design and testing, and with the men who volunteer for new and dangerous jobs that determine the effects of space flight on the human body. Lt. Gen. Thomas S. Power, USAF, head of the Air Research & Development Command, forewords this excellent book.

In a field closely allied to rocketry, a new four-volume series is under way, *Principles of Guided Missile Design*, edited by Capt. Grayson Merrill, USN. The series plans comprehensive treatment of basic principles in missile technology. First to appear is *Guidance*, by Arthur S. Locke and personnel of the Naval Research Laboratory (D. Van Nostrand, $12.50). It considers the problems encountered in directing missiles from launching to target. A highly technical book, it is excellent for engineers, military and civilian scientists, and college graduate students.

Another missile volume, *Guided Missiles in War and Peace*, by Maj. Nels A. Parson Jr., USA (Harvard Univ. Press, $3.50), treats the history of missile development and the missile as a military weapon. A less technical work, it is of interest to both layman and the professional airman.

Tops among the recent spate of WW II "escape stories" is *We Die Alone*, by David Haworth (Macmillan, $5.00). This thrilling yarn narrates the incredible adventure of a Norwegian, Jan Baalsrud, sole survivor of an ill-fated sabotage mission into German-occupied Norway. Baalsrud's long evasion trek through bitter cold, mountainous Norway into Sweden includes almost unbelievable accounts of hardship, suffering and courage.

Air Force fiction receives a noteworthy addition with *The Hunters*, by James Salter (Harper and Brothers, $3.00), a novel of jet air-to-air combat in the Korean war. The men of the AF's 4th F/I Wing at K-14 (Kimpo) have only one standard—how many MIGs you've downed. The fierce competition into which this leads, sets the pace for an outstanding air novel of swirling jet air combat, adventure, tension, and driving emotions. The author (Salter is a pen name) is a regular AF officer, Korean vet, and presently an AF jet squadron commander.

Fiction, frank, and written with realism, *The Long Night*, by Martin Caidin (Dodd Mead, $3.00) tells the story of an atomic attack on a modern American city and how the Civil Defense machinery goes into action as the city fights for its life. At 9:33 P. M. one November night enemy bombers unleash the atom over Harrington, USA, pop. 500,000. What follows is pictured in scenes of terror, death, and destruction, compounded by the firestorm phenomenon. Caidin's info came from Japanese records of Hiroshima and Nagasaki and from personal interviews with Japanese authorities who lived through the atomic attack.

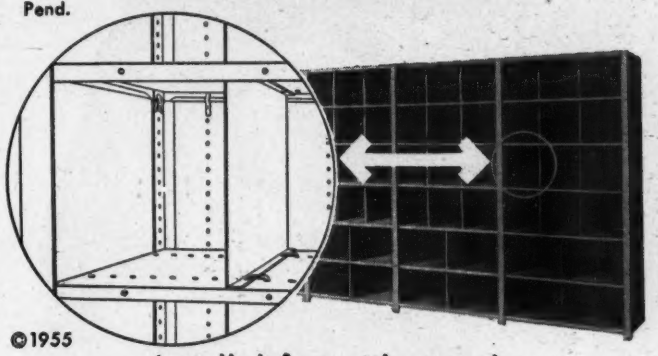
AF subject paper-backs are currently on the stands. *Down*, by Walt Grove (Dell Publishing Co., 35¢), a pocket original, is an adventure novel of an AF jet pilot's crash and rescue in the lonely Arctic. *The Secrets of Outer Space* by Lloyd Mallan (Fawcett Publications, 75¢) is a companion volume to his *Men, Rockets and Space Rats*.—END

THE NEWEST AND BEST IN SHELVING!

KLIP-BILT®

STEEL SHELVING

Pat. Pend.



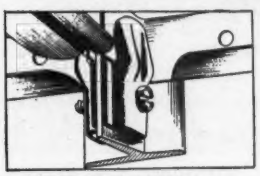
©1955

installed fast without tools . . . combines high strength with low installation cost

KLIP-BILT, the revolutionary new boltless steel shelving, provides the fastest, simplest assembly of high strength storage equipment yet developed!

All fastening is with simple clips . . . easily installed by hand yet ingeniously designed to hold shelves, panels, dividers, and T-posts of various thicknesses pressure tight. Clips can be quickly disengaged, too, to permit easy rearrangement or disassembly of shelves.

Manufactured in standard sizes and parts.



T-POSTS PUNCHED ON 1½" CENTERS

SHELF CLIP

Just three parts for quick installation. Hardened cadmium-plated threaded stud and two heavy steel clips, one having stamped thread. Holds shelf flange *tight* against tough, rail steel T-post to prevent shelf from sagging when heavily loaded.

PANEL CLIP

Secures back panels to shelf flanges. Engaged at each shelf level. Quickly installed from *in front* of shelving.

DIVIDER CLIP

Locks into two shelf holes to provide firm anchorage. Clips are flat, do not interfere with storage.

A SHELF FOR EVERY LOAD

A. For average loads
B. For heavy loads (Front and rear flanges reinforced.)
C. For extra heavy loads (Type B with sides and center reinforced.)

Label holders clip to shelf.

WRITE FOR BULLETIN 701

The FRICK-GALLAGHER MFG. CO.

103 S. MICHIGAN AVENUE, WELLSTON, OHIO

Branch Office: 250 S. Broad St., Philadelphia 2, Pa.

Specialists in Storage Planning and Manufacture of Storage Equipment.

NOW...a powerful electric STARTER FOR MIDGET TURBOJETS

Starting a lightweight turbojet engine, such as the 1000-pound thrust Fairchild J44, is never a problem with the rugged Model D62 starter developed by Jack & Heintz. This starter is an electric, direct cranking unit which has substantially bettered the starting time limitations established by the engine manufacturer.

Field Proven

The D62 starter is establishing an enviable operational record on the small J44 turbojet engines being used as wing-tip thrust assist power plants on Fairchild's C-123B Assault Transport. Modifications of the D62 are in use on other specialized applications including Solar's gas turbine driven a-c power pod installations on the Convair C-131B. In addition, a new higher speed starter extremely light in weight for small turboprop engines has been developed and is being engine tested.

Special Features

Features of the J&H Model D62 include: grounded, irreversible, series-wound, interpole-type motor; planetary reduction gearing with multiple disc torque limiter; and an automatic jaw meshing mechanism, providing quick-acting positive engagement.

This small power package or a modification of it engineered to your particular application may be the answer to your starting problem. Send for complete data including performance curves and dimensional drawings. Write Jack & Heintz, Inc., 17640 Broadway, Cleveland 1, Ohio. Export Dept.: 13 E. 40th St., New York 16, N.Y.

CHARACTERISTICS

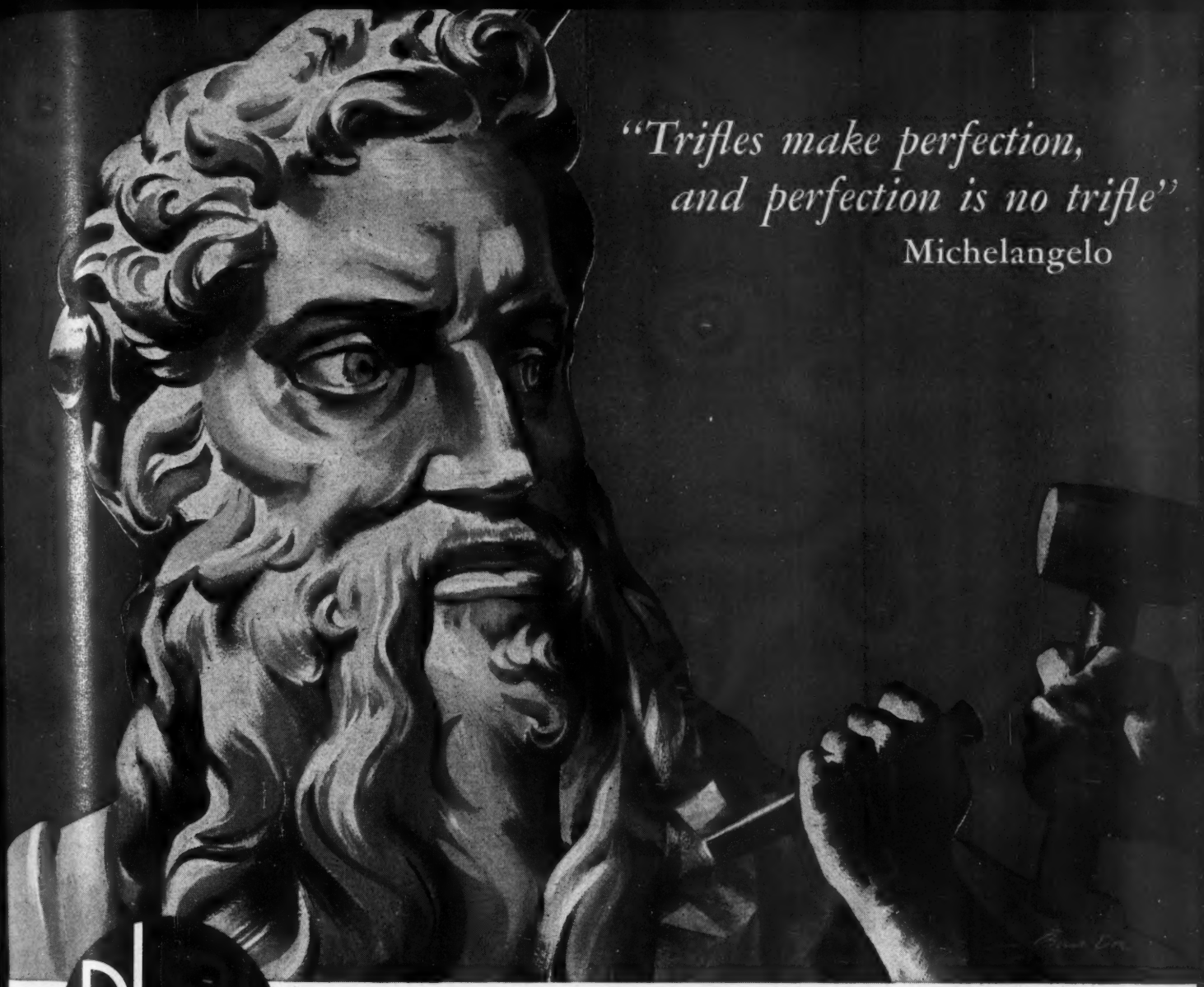
Engine Mounting Pad	AND20002, Type XII-S (except opposite rotation)
Starter Input:	
Voltage, d-c	22-28
Current, amp (max)	450
Starter Output	30 lb-ft @800 rpm, 24 v
Gear Reduction	7:1
Torque Limiter:	
Breakaway Torque, lb-ft (max)	80
Slipping Torque, lb-ft (max)	65
Slipping Torque, lb-ft (min)	55
Jaw Teeth, number	3
Rotation, viewed from anti-drive end	Counterclockwise
Weight, lb (approx net)	25

OPPORTUNITIES FOR ENGINEERS

There's a promising future for electrical and mechanical engineers at Jack & Heintz. Write Manager of Technical and Professional Placement, today, for illustrated, descriptive booklet.

©1955 by Jack & Heintz, Inc.

JACK & HEINTZ *Rotomotive* AIRCRAFT EQUIPMENT



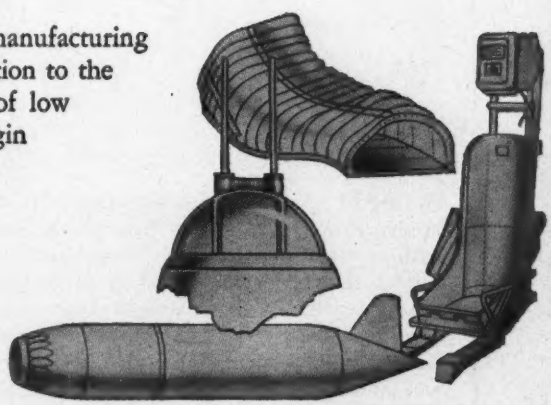
Rheem

GOVERNMENT PRODUCTS DIVISION

Michelangelo was a great perfectionist. He knew that where perfection is desired, attention to minute details is indispensable.

The people at Rheem know this too. For in every phase of Rheem manufacturing ... from drawing board to finished product ... perfection, by attention to the smallest detail, is the goal. Now add to this an enviable record of low per-unit cost, and on-time completion schedules, and you will begin to understand why the name *Rheem* has become a symbol of both quality and dependability.

Rheem's Government Products Division is presently in quality development and production on air frames, missile and jet engine components, airborne ordnance, electronics and ordnance materiel.



YOU CAN RELY ON RHEEM

Rheem Manufacturing Company • GOVERNMENT PRODUCTS DIVISION

DOWNEY, CALIF. • SAN PABLO, CALIF. • WASHINGTON, D.C. • PHILADELPHIA, PA. • BURLINGTON, N.J.

SHOOTING THE BREEZE

WITH JOHN F. LOOSBROCK, MANAGING EDITOR, AIR FORCE MAGAZINE

A giant of aviation passed with the death of Marshal of the Royal Air Force, Viscount Trenchard, in London. Lord Trenchard was a pioneer in strategic bombing, became the first chief of the Air Staff in 1918.

☆

News item from *The Washington Post*:

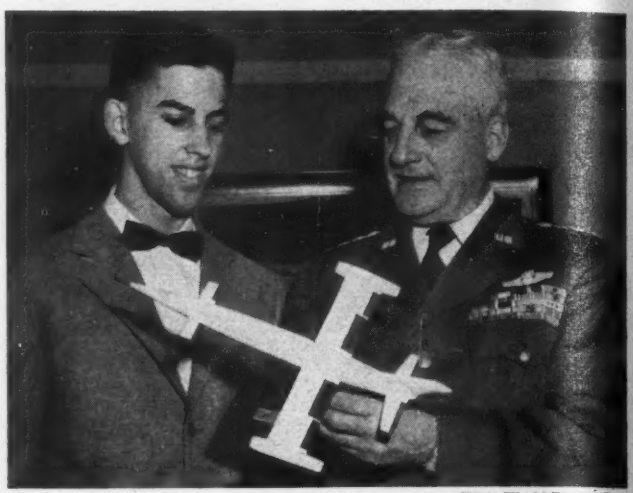
"Chief Petty Officer Norman Gillikin was one of the most popular men in the Navy's Pentagon press corps when he left for the Far East two years ago. Now he's back at the Pentagon, still popular but perhaps not so much with the Navy. He's now Sgt. Gillikin of the Air Force press desk. He switched uniforms after sixteen years in the Navy." Stout fella, Gillikin.

☆

Gen. Carl Spaatz, writing in *Newsweek* Magazine, recently grasped a nettle that has been gingerly ignored for some time. In connection with the military budget for Fiscal Year 1957, General Spaatz said:

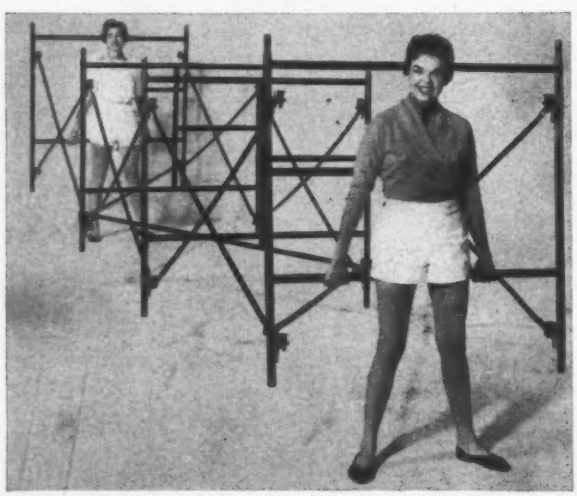
"The defense dollar could be made to go twenty-five percent further than it will go, if it could be wisely and prudently spent. However, for this to be possible we need true unification of the services—not the partial and half-hearted unification we now have. All branches of the armed forces should be placed under the Secretary of Defense with a Chief of Staff and a General Staff, carefully selected from outstanding graduates of the National War College. Personnel should be dressed in one uniform except for ceremonial occasions. Then traditional dress uniforms of the individual services should be worn. Career personnel of any service should have freedom to transfer to any other service without loss of rank. The opportunities thus created would make career service more attractive and increase efficiency.

"Eventually, this would eliminate the service rivalries which keep obscuring the primary defense problem, which is to maintain an Air Force capable of taking and keeping command of the air any time, any place in the world. This kind of unification would permit the nation to establish an adequate defense system and to maintain it indefinitely without overtaxing the national economy."



Wide World Photos, Inc.

Kenneth Gehrke, 17, of Cleveland, gives Gen. Nathan F. Twining his model of a futuristic, 2,000 to 8,000 mph ramjet transport. Gehrke won a model-building contest sponsored by the Chamber of Commerce in Dayton, Ohio.



According to the Waco Manufacturing Co., Minneapolis, these "frames and braces" are made of high carbon steel tubing. They can also be made into rolling towers by the addition of casters and have the advantages of light weight, heavy load capacity, low cost, easier storage, and increased mobility. They are, of course, talking about their new lightweight scaffolding. The girls? All we know is that they are carrying twenty-one feet of scaffolding capable of supporting 4,200 pounds.

☆

Sidelight on AFA's Jet Age Conference—A note on the press room bulletin board read, "Orville Wright: Please call your brother." It was signed "Kitty Hawk Noise Abatement Society."

☆

There's a bill in Congress to provide free barber services for military personnel—a true fringe benefit. We wonder if this applies only to haircuts or whether it includes free shaves, manicures, shampoos, massages, hot oil treatments, and shoe shines.

☆

Here's a project we think worthy of support. Col. Dean Hess, presently special assistant to the Deputy Chief of Staff, Personnel, is heading a non-profit group called HOPE, Inc. Its purpose—to funnel financial aid to the Orphans Home of Korea. The Orphans Home

(Continued on page 29)

Avco Lycoming makes more time for business

Challenged by a surging economy, the most urgent single need of business today is *time*. Today, business gains that time through flight. A growing private airfleet—already larger than those of all scheduled airlines—is shortening the distance between appointments.

To power this bustling fleet—so safely and so dependably that a twin-engine plane can fly and land on *one engine alone* if necessary—business looks to Lycoming. More *Lycoming* engines roar in today's advanced executive aircraft than any other engines in the world. And Lycoming supercharged engines, the first available to business, are driving private aircraft higher and faster than ever.

And continually—Lycoming scientists search out *still finer* techniques of power and propulsion . . . to save business time, to keep business soaring . . . to make America stronger.

Find out how private flying can save you time. Write for booklet, "The Review of Executive Aircraft." Or for help on any problem involving Power—wire, phone or write to Avco Defense and Industrial Products, Stratford, Conn.

Avco Lycoming

defense and industrial products

Avco Defense and Industrial Products combine the scientific and engineering skills, and production facilities of three great divisions of Avco Manufacturing Corp.: Lycoming; Advanced Development; Crosley — to produce power plants, electronics, airframe components, and precision parts.

FOR A COPY OF THIS BECK ILLUSTRATION, SUITABLE FOR FRAMING, WRITE TO PUBLIC RELATIONS DEPT., AVCO DEFENSE AND INDUSTRIAL PRODUCTS, STRATFORD, CONN.

CONTINENTAL DEFENCE IS AVRO AIRCRAFT'S BUSINESS

In RCAF operational multi-squadron service in Canada, squadrons of CF-100s will begin duty with NATO forces in Europe by 1956

DROGUE PILOT RIDES RED

To practice collision course interception—the new one-pass radar-controlled attack technique—the RCAF needed "something fast and high to shoot at". Avro Aircraft supplied modified CF-100s which tow specially designed drogues attached to 12,000 feet of cable. The planes are painted a vivid fluorescent red so they won't be mistaken for the target.

Practicing this new collision course attack or the grim business of repelling enemy planes, Avro Aircraft's CF-100s are the mainstay of Western Hemisphere defence. Men of the RCAF patrol Canada's northern approaches on a 'round-the-clock alert in these mighty all-weather night interceptors.

Avro Aircraft's CF-100s add deadly striking force to the air defences of the free world. No other all-weather night interceptor in service today can equal them for power and range.

AVRO AIRCRAFT

AVRO AIRCRAFT LIMITED MALTON, CANADA

MEMBER; A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

started during the Korean war when Colonel Hess and other USAF men flew hundreds of war orphans out of the fighting zone to safety. The story of "Operation Kiddycar" is being made into a movie by Universal-International and will also appear this fall in book form, published by McGraw-Hill. Profits will go to the orphanage. Anyone wanting to assist may mail donations to HOPE, Inc., Box 85, Washington 4, D.C.

☆

A scientific type we know summed up the missile problem this way—"The Air Force should put less effort into 'missiles' and more into 'hittiles.'"

☆

It's little wonder the public is slightly confused over the missile business. Senator Leverett Saltonstall, ranking minority member of the Senate Armed Services Committee, recently told a Buffalo, N. Y., audience:

"Added to this increasing strength each month is our stockpile of intercontinental ballistic missiles, which represent the most modern and the most devastating weapon of war in existence today."

Calling our as-yet-nonexistent supply of ICBMs a stockpile is a little like saying you have a woodpile because you've planted an acorn.

☆

An AP story out of Carswell AFB, Tex., tells of a new rule posted on dependents' dental care. It says, "Mothers reporting to the clinic for dental care will not bring their children with them." Seems an irate three-year-old boy thought the dentist was hurting his mother and promptly bit the unsuspecting driller on the leg.

☆

World War II Vignette: In a war filled with bit-time operators, one of the smoothest was a master sergeant in charge of a transient mess at Stephensville, Newfoundland.

The short-snorter bill fad was going full-blast. So was traffic across the North Atlantic. Several hundred men a day—crews and passengers—were passing through Stephensville. All had a meal in the sergeant's transient mess. After each new batch of arrivals had eaten, the master sergeant would mount a table and give a small lecture on the ancient and honorable custom of the short-snorter bill. He would conclude something like this:

"Sir, I bet you thought I'd forget the wheels again."

A new bombing-navigation system called BRANE (Bombing Radar Navigation Equipment), developed by IBM is to be installed in B-52s. This emblem appears on the test plane.

"Now you are in your first foreign country. A Canadian dollar bill is just the thing to start your collection. I'll be glad to exchange a Canadian bill for a US dollar bill before you leave."

Nine out of ten of the transients took him up on the offer . . . after all, they reasoned, it was just a swap, a buck for a buck.

What they failed to take into consideration was the fact that the Canadian dollar in those days was worth anywhere from eight to eleven cents less than a US bill. The sergeant never informed them of this financial fact-of-life. Why should he? He was making about a dime apiece on every transient crossing the North Atlantic.

☆

In a message read at the dedication of new housing at Presque Isle AFB, Me., the senior Senator from that state, Margaret Chase Smith, said, in part,

"May this [dedication] be symbolic recognition of the truth that the airmen who man our aircraft in the air security of our country are no better defense performers than the housing that shelters them and their families. . . . In the final analysis housing is just as operational as aircraft and airmen, for the best aircraft is worthless if a pilot is ill from poor shelter and either can't fly the plane or crashes the plane from his physical or mental condition caused by poor shelter and home conditions."

(Continued on following page)

All of which reminds us that, even with the housing provided in the FY 1957 budget just presented, the AF is still many units short of adequate housing.

☆

Your own automobile is an excellent nuclear bomb shelter, according to Dr. Stafford L. Warren, dean of the medical school and director of atomic energy projects at the University of California at Los Angeles. Dr. Warren, who was wartime chief of the medical section of the Manhattan District, says he carries enough food and water in his car to last a week. Also, he said, he carries a can opener, a hatchet, blanket, pliers, a tow rope, and a 6x6-foot sheet of canvas.

☆

It happened in the non-commissioned officers' club of an Air Force base in Japan last New Year's Eve. The grizzled master sergeant, a veteran of the club's bar,

We were pleased to see Savannah Gay, currently in Milton Caniff's "Steve Canyon," reading AIR FORCE the other day.

arrived spic and span, freshly shaved, shoes polished, eyes clear. No one had ever seen him so completely and utterly sober. Not that he ever got really drunk. He just loved his beer and he used to soak up a half-a-case a night—every night.

This night, however, he muttered, "Just give me a coke, please."

"What gives?" asked the bartender. "It's New Year's Eve!"

The master sergeant sneered, "New Year's Eve! Amateur night!"

☆

Around our shop the cumbersome abbreviation, "ICBM," has become the easier-to-say "Ick Boom."

☆

Here's a Briton who anticipated Winston Churchill's famous airpower statement by several decades. A T. F. Farman, writing in *Blackwood's Magazine* in *October 1915*, predicted:

"It may be that, though the aeroplane can perform most of the services rendered by all the traditional arms, its existence will not entail the suppression of a single one of them. Nevertheless there seems good reason for believing that the great battles of the future, on which the destinies of nations will depend, will be fought by mighty aerial fleets and that the land forces of the victors will complete the conquest by the prompt occupation of the enemy's country, of which the army will be at their mercy, especially because the victorious aerial fleet will surely be able to aid most materially in constraining it to surrender.

"The military avions of today [1915], each carrying many hundred pounds of powerful explosives, can penetrate 200 or 250 miles over a hostile country and return to their base of operations. It may be taken for granted the scope of their action will be vastly increased in the near future, and that the bombarding aeroplanes will transport a much more formidable load of bombs. Those heavily laden machines will be escorted and protected by fighting avions against the attack of the enemy that will inevitably seek to oppose their progress. To imagine, or rather to foresee, the paramount importance aerial vessels of all sorts will assume in the future, it is only necessary to realize the fact that every first-class power will be able to build and man, not hundreds, but, if necessary, hundreds of thousands of aeroplanes. And the state which may thus obtain the mastery of the air will be able to impose its authority, for good or ill, on the other nations of the world. An insular position, like that of Great Britain, could not save the land from invasion by the aerial forces of a continental power. To insure their safety, the islanders must not depend on the sea to protect them, or on their navy. The only means of opposing such an invasion would be a superior aerial fleet."

☆

To the 1,091 Department of Defense directives in force as of February 1, Secretary Charles E. Wilson added the 1,092d. Since subordinates were not paying sufficient attention to his directives, in Mr. Wilson's opinion, he issued a directive directing them to pay more attention to his directives.

☆

Here's how one anonymous hangar hand sums up the convertiplane business:

"Design a plane," the head men say,
It must be built in such a way
That the dumbest mug can fly hands off,
Make the hardest landings still feel soft,
Make up for brains that the pilot lacks
Make the seats lean forward and still lean back.
It must be safe and in the main
Be able to stand a hurricane.
It must be fast and not land hot
(What a helluva job the designer's got)
Fast and light and comfortable too,
With a cruising range to Timbuktu.
Of course, this is no common hack,
But must carry the load of a ten-ton Mack.
It must climb straight-up and land straight-down,
But the pilot must scarcely feel the ground.
And one last word the head men say,
"It's gotta be finished by yesterday."
On second thought there's one thing more,
"They'll have to sell at the ten-cent store."

☆

Square that hat, Madam! Mrs. Lauris Norstad, wife of the general, is quoted as criticizing the way some American women dress abroad. Slacks, says Mrs. Norstad, while accepted at home, are not well received in Europe. They wouldn't be accepted most anywhere, we think, if the average gal were equipped with a rear-view mirror.

VERSATILE NEW STRONG MAN OF THE USAF

C-130 HERCULES

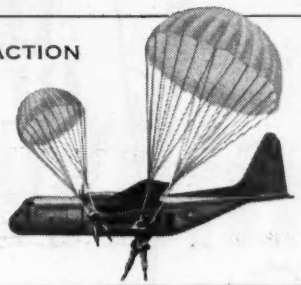
Meet the Air Force's first prop-jet transport for military air power and peacetime airlift.

Powered by four Allison T56 prop-jet engines, this mighty aerial carryall flies cargo and men *farther, faster and at less cost* than any other combat transport.

Destined to make history, the USAF Hercules is now in production at Government Aircraft Plant No. 6, Marietta, Ga., America's first prop-jet production line for transports.

DROPS 'EM EASY, READY FOR ACTION

64 paratroops get there fast

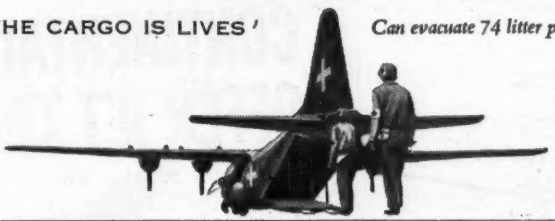


READY AT A MOMENT'S NOTICE TO KEEP THE PEACE .

Capacity: 92 fully-equipped troops

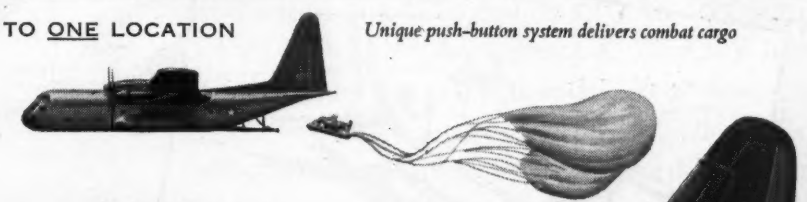
WASTES NO TIME WHEN THE CARGO IS LIVES'

Can evacuate 74 litter patients



25,000 POUNDS SPOT-DROPPED TO ONE LOCATION

Unique push-button system delivers combat cargo



MORE GET-UP-AND-GO FOR COMBAT CARGO

20 tons airborne in 12 seconds

LOCKHEED

LOCKHEED AIRCRAFT CORPORATION, GEORGIA DIVISION • MARIETTA, GEORGIA

LOOK TO LOCKHEED FOR LEADERSHIP

GOVERNMENT AIRCRAFT PLANT NO. 6

MORE JET

Panagra to Offer Jet Air Travel

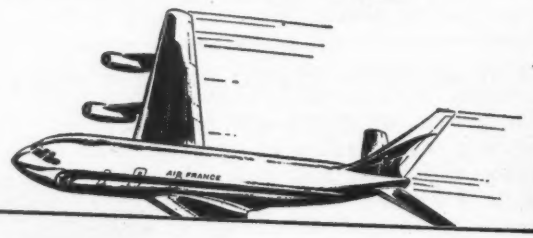
Douglas DC-8s with Pratt & Whitney engines will cut flying time in half between New York and Buenos Aires

Pan American-Grace Airways, a pioneer of air transportation in South America, prepares to meet the coming jet age with orders for Douglas DC-8 jet transports.

Panagra's routes in South America. They will reduce travel time by one half. For instance, the present 22-hour time for the 6,000-mile flight from New York to Buenos Aires will be cut to approximately 11 hours.

Deliveries of the DC-8s will begin in 1960. These huge airplanes will be powered by JT4 jet engines designed, developed and produced by Pratt & Whitney Aircraft. These advanced two-spool, axial-flow jet engines make possible

AIR FRANCE BUYS JET AIRLINERS



CONTINENTAL AIR LINES TO OFFER JET TRANSPORTATION

with Whitney engines new service 1959

Lines pioneers again with new fleet of Boeing 707 jet ... jet airliners will fly be... Chicago via Denver starting in August, 1959, ... travel speed and com...

...ng 707 comes from four ... produced by Pratt & ... fly from Denver to ... Denver to Los Angeles

...ir travel. Behind it ...team-work and action ... is typical. June 21 ...omas started operations between Denver and Pueblo, Colorado. The three airplanes used then carried five passengers, and were powered by one 10 ton engine, made by Pratt & Whitney Aircraft.

Now Continental Air Lines is an important element of the American transportation industry, currently serving 50 key cities in the thriving West and Southwest. Pratt & Whitney engines have powered every transport flown by Continental Air Lines from the start of the airline to the present time. And through the years as aviation grew, Pratt & Whitney has supplied Boeing, maker of the new 707 jet liners, with dependable power plants. The two firms have worked together to develop many outstanding airplanes, from early commercial transports to the world's fastest and largest jet bombers.

In the age of jet air travel now beginning Pratt & Whitney Aircraft's dependable jet engines will play a major role. They will help demonstrate again that the U. S. aircraft industry leads the world in commercial transportation.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation · East Hartford, Connecticut

Sabena Jet Liners to cut flying times in half

BELGIAN WORLD AIRLINES ORDERS BOEING INTERCONTINENTALS WITH PRATT & WHITNEY ENGINES

Sabena Belgian World Airlines, one of the world's pioneering airlines now in its 34th year of international operations, continues its progressive policy with its purchase of a new fleet of Boeing Intercontinental jet airliners.

When the jet airliners enter service in 1960, flying time between New York and Brussels will be cut from 12 hours to 9½ hours. The present 17½ hour flight from Brussels to Leopoldville will be cut to less than 7½ hours.

The Boeing Intercontinental will be powered with JT-4 jet engines designed, developed and produced by Pratt & Whitney Aircraft. These advanced engines of axial-flow, two spool design will set a new world standard for aircraft power plants, giving the airliners outstanding flight performance. All of Sabena's flights over its 60,000 miles of air routes are currently made in aircraft powered by Pratt & Whitney engines.

Now that the age of jet air travel is arriving, the major role played by Pratt & Whitney Aircraft engines will continue, making possible the world's finest commercial air travel.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation · East Hartford, Connecticut, U.S.A.

PRATT & WHITNEY AIRCRAFT · DEPENDABLE ENGINES

AIRLINER FLEETS to fly with Pratt & Whitney Engines

Douglas DC-8s and Boeing 707s with Pratt & Whitney Aircraft JT3 and JT4 jet engines ordered by additional U. S. and foreign airlines. Four more U. S. and foreign operators have placed quantity orders for jet airliners powered with Pratt & Whitney Aircraft jet engines. They are Continental Air Lines, Air France, Sabena, and Panagra, making a total of eleven airlines which have taken this important step toward the jet air age. Still more orders are expected.

Orders for jet airliners with Pratt & Whitney engines were placed previously by Pan American World Airways, United Air Lines, National Airlines, American Airlines, KLM Royal Dutch Airlines, Braniff International Airways, and Eastern Air Lines.

Both the Boeing 707 and the Douglas DC-8 which have been purchased by these leading airlines have been designed to fly with the world's most powerful jet engine in quantity production, the JT3, and its advanced version, the JT4. Both of these Pratt & Whitney Aircraft engines are of twin spool, axial-flow design. The JT3's military counterpart, the famed J-57, has flown since 1953 in record-breaking fighters and bombers, and has accumulated thousands of hours in the air with outstanding dependability.

Pratt & Whitney engines have spurred many advances through aviation history. The Wasp, the Hornet, the Twin Wasp, the Double Wasp and the Wasp Major have led the way since the mid-1920s. Now the JT3 and JT4 will supply the power for the world's finest *jet* airliners, introducing the age of jet travel.

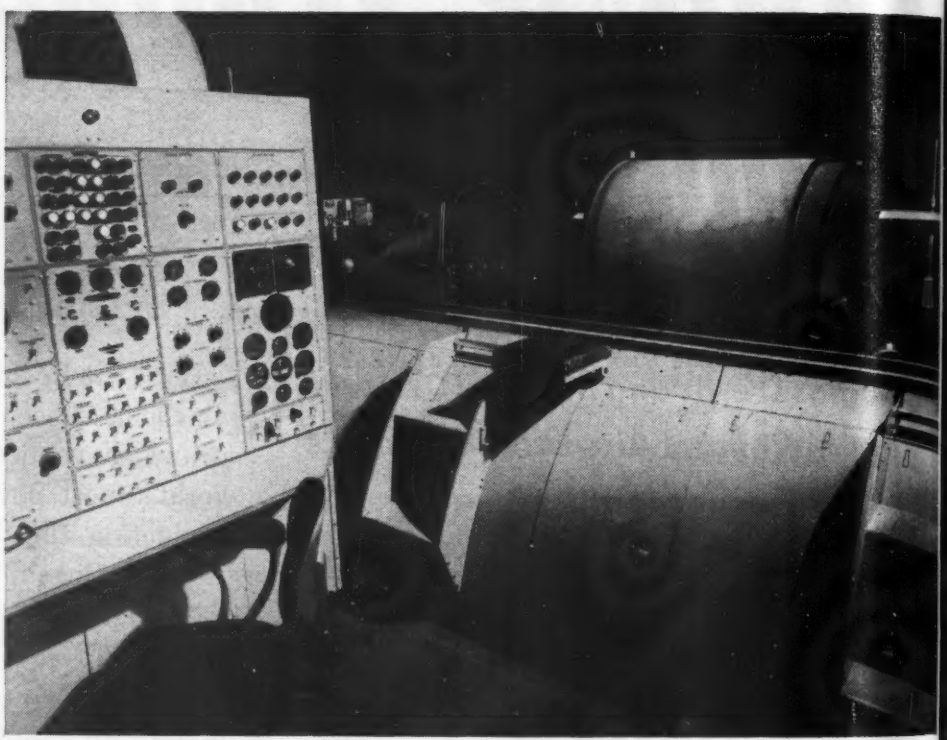
PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation • Main Office and Plant: East Hartford, Connecticut
Branch Plants: North Haven—Southington—Meriden

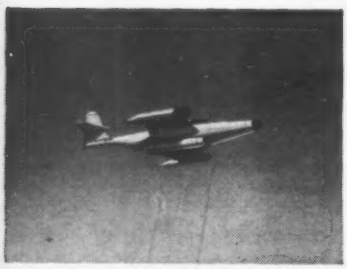
ON THE GROUND ONLY SIMULATORS PREPARE PILOTS FOR ALL THESE JET FLIGHT CONDITIONS

To familiarize today's student pilot *completely* with the complex jet he will fly, Link Aviation, Inc. recreates the entire range of flight characteristics in flight simulators.

This complete on-the-ground training is available *only* through simulators — such as this Link F-89D Jet Flight Simulator. Only through them can he experience all flight contingencies, normal and emergency, and thus develop the techniques and skills necessary to operate his plane with a maximum of efficiency.



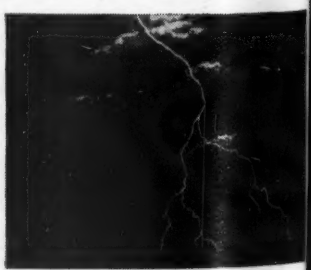
Link F-89D Jet Flight Simulator, developed by Link Aviation, Inc., in cooperation with the Wright Air Development Center, USAF.



Normal aircraft and engine operation: Flights and missions are simulated in Link's F-89D, duplicating all details of Scorpion performance exactly.

Instrument flying: Personnel learn to use the complex electronic instruments that guide this mighty air weapon in all climates and conditions, day and night.

Crew coordination: Pilot and radar operator train together to fly together more efficiently, making routine and combat "missions" on the ground.



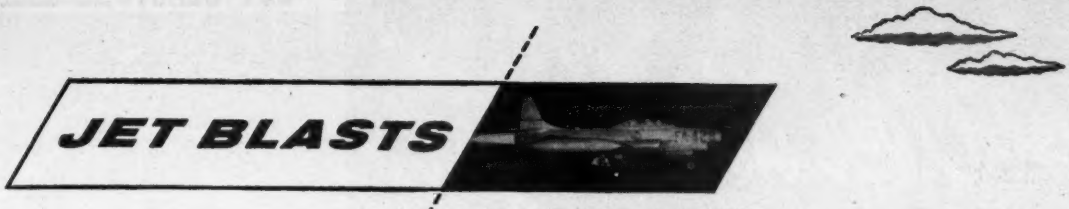
Emergency conditions: Simulated storms, instrument failure and many other flight emergencies train F-89D crews in procedures that could not normally be practiced.

LINK AVIATION, INC.

Pioneer and World's Largest Producer of Jet Flight Simulators

BINGHAMTON, NEW YORK

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORP.



LET'S HAVE YOUR JET BLAST

In "Jet Blasts" you can sound off on any subject you want. We'll pay a minimum of $10 for each "Jet Blast" used. All letters must be signed but we'll withhold names on request. Keep letters under 500 words. "Jet Blasts" from service personnel do not necessarily report official policy.

AF Commanders for Army Divisions?

A revision of military tactics brought about by the decisive power of air has introduced additional problems in the control responsibilities of air and ground forces.

The United States Army, recognizing the necessity for airpower, which it does not have now, has launched a public campaign to regain its airpower. Such airpower is in duplication of existing forces now possessed by Tactical Air Command.

In order to effectively utilize ground troops, the Army recognizes the necessity for ground support. But, to maintain its effectiveness as a dominant factor in any military campaign the Army desires close support aircraft be assigned to it as an organic unit *under control of the ground commanders.*

What the Army has failed to state is that airpower as such must precede the Army into battle, eliminating strongpoints and enemy opposition in this atomic age so that the ground forces can operate and serve as an occupation force.

The Army is without troop transport aircraft in an age when surface transportation is no longer fast enough or safe enough for the movement of combat troops. The Army now wants to obtain its own transports, although such transports now exist in the Air Force for use by the Army as it sees fit. The Army recognizes the effect of slow transportation in regard to the time factor which will be involved in another war. It also recognizes that without such organic aviation the Army becomes a secondary military force dependent entirely upon the Air Force for both protection and transportation.

The Army solution for regaining its status as a major force in the department of defense is to regain partial control of this nation's airpower. Under the present allocation of responsibilities the Air Force is now the major and dominant military force in this country. The Army's reasoning is entirely accurate in those areas where it recognizes the necessity to couple surface and air units for combined operations. However, the Army strategy is to take the dominant force and give it a secondary role, that of support for surface forces. The Air Force would still retain the responsibility of counter air and interdiction under the Army concept.

By applying the Army reasoning in reverse, admitting the primary role of airpower, why not maintain the Air Force tactical superiority in future wars and utilize surface forces in concert with air campaigns as support elements under the control and direction of the primary military force?

Rather than break up combat air forces, designed to operate as a unit, and pass them out piecemeal to operate under the direction of several ground commanders, why not place Army divisions under air commanders and use them in controlling and occupying areas attacked by air forces?

This would give this nation maximum use of all military forces. As airpower strikes and destroys important military elements of a nation which has launched aggression and controls the air over the aggressor, does it not follow that the responsibility of assuring complete capitulation of foreign ground forces by occupation should be the responsibility of that same commander?

Such Army divisions, under the control of the Air Force, would be assured the adequate transportation desired by the Army and would be moved in accordance with the dictates of the situation without loss of valuable time in coordination between the two services. In addition, it would not increase the burden of the taxpayer since it would eliminate the establishment of an Army troop carrier force. The same economic rule applies to close support functions. Rather than provide aircraft to the Army, provide the troops to the Air Force, allowing the air service to fight the close support battles with existing aircraft and troops and eliminate the necessity for Army aircraft as such.

In essence we would be providing the Air Force with ground troops just as we provided the Navy with ground troops—the USMC. When the Navy was the dominant force and the sea was the key to survival, the dominant force controlled ground forces necessary to enforce decisions affected by the Navy. Let the same rule apply today.

First Lieutenant

Where Are Our Messerschmitts?

Slightly less than a decade ago when the Air Force and Navy were hassling over the capabilities of the B-36, a group of our citizens approached Willy Messerschmitt, in my opinion the greatest fighter aircraft designer of our generation. They asked him if he could design a fighter that could shoot down a B-36 bomber. He replied confidently, "I can design a fighter capable of shooting down any bomber in the world—and then I can turn right around and design a bomber that no fighter will be able to shoot down!"

If Willy Messerschmitt's statement sounds contradictory, don't believe for a single instant that he was trying to be facetious. He was merely stating the bold truth of our air age that few people want to believe. Herr Messerschmitt was, and probably still is, an aircraft designer of unusual foresight. He is one of the few aircraft designers of our time who conceived, designed, built, flew, produced, and equipped tactical fighter squadrons with a superior air weapon—the ME-262 twin jet—before the weapon was made obsolete by the opposition's counter weapon.

Today we are trapped in one of the most vicious airpower rat races we've ever faced; and if we don't soon do something about it we're going to

(Continued on following page)

"Just Over the Horizon"

EXECUTIVE PLANES
with C.A.E. Turbine Power

CONTINENTAL
J69

Compact, easily serviced. 920 lbs. thrust. Single-stage centrifugal compressor, single annular combustor, single-stage turbine; hollow-shaft fuel introduction provides excellent atomization and is non-clogging—eliminates need of high-pressure fuel system.

"The era of jet-powered business aircraft . . . undoubtedly is just over the horizon." . . . This is the conclusion* reached by Herb Fisher, Chief, Aviation Development Division, The Port of New York Authority, after flying the MS 760 twin jet executive transport which Beech Aircraft Corp. has been demonstrating in America this summer. U. S. version of the ship will be powered by Continental J69, raising the service ceiling to 35,500 feet and maximum speed to 410 mph. . . . This pioneer twin jet transport marks an important addition to the list of applications for which the J69 is admirably suited in performance characteristics, and design. The engine is now in production at C. A. E.

*See "Executive Pilot's Report: MS 760", Skyways, August 1955, P. 12.

CAREERS FOR ENGINEERS

Continental Aviation & Engineering Corp. has openings for technically-trained men. Engineers interested in positions with almost unlimited opportunity for advancement, in this new and challenging industry, are invited to write for information.

CONTINENTAL AVIATION & ENGINEERING CORPORATION
12700 KERCHEVAL AVENUE, DETROIT 15, MICHIGAN
SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION

JET BLASTS—CONTINUED

blow our economic top! Should the lid fly off our seemingly bottomless cash box, then all we have done thus far to stem the tide of world Communism will be for naught. We must eternally keep in sight the fact that we are capitalists and if we do not maintain control of our economy we will lose our most valuable weapon—the dollar bill!

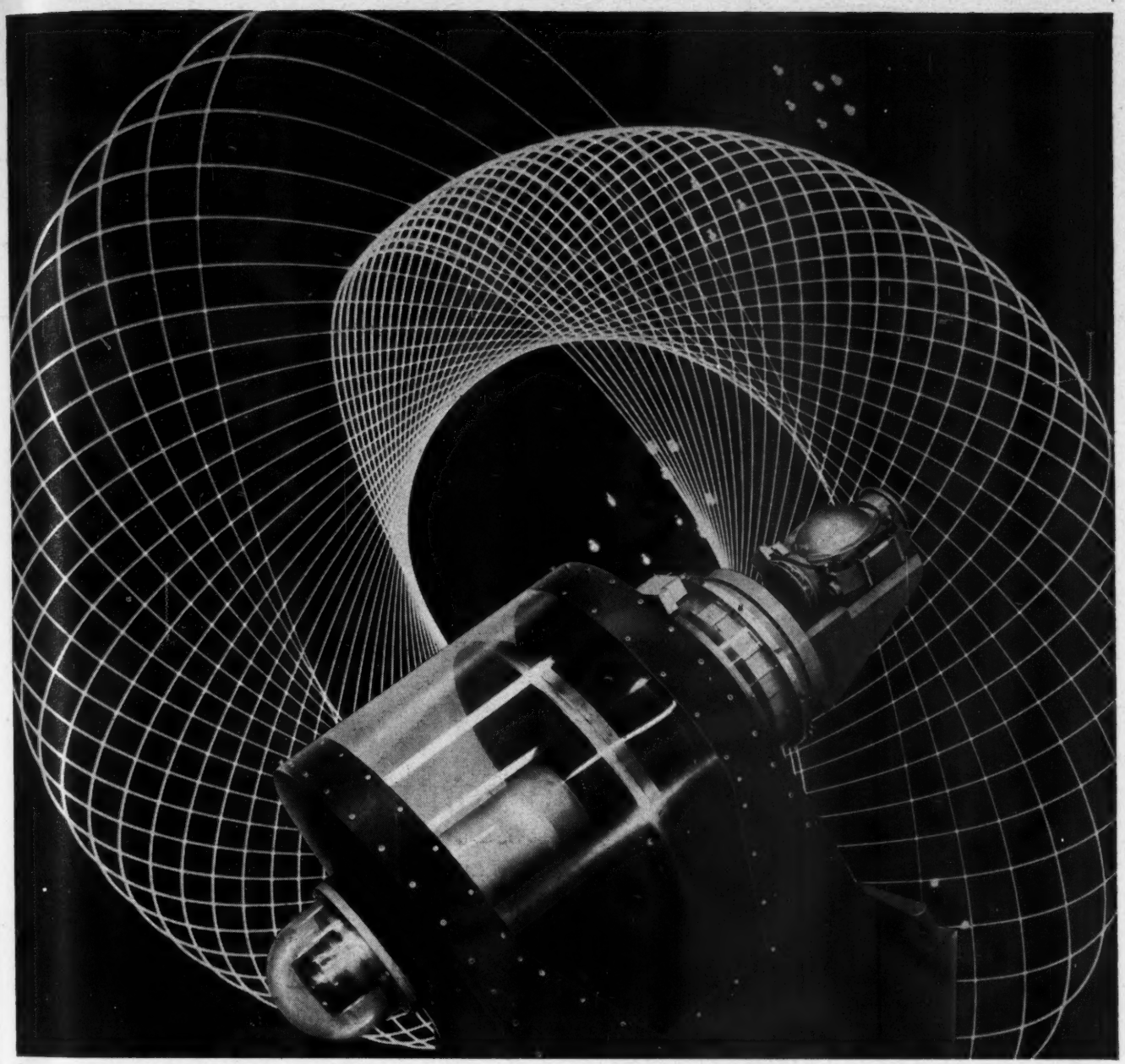
The money we waste building yesterday's aircraft today is pitiful. The situation is like the one Willy Messerschmitt was talking about. We are designing and test-flying air defense fighter aircraft today that can shoot down any Russian bomber in operation, but before we can get our air defense fighters into production and into operational squadrons, the Soviets come up with an operational bomber that our latest production line ADC fighter cannot shoot down.

Our air defense concepts of air warfare are decadent. We have neither kept abreast of our potential enemy's developments nor countered his new weapons with better air weapons. The T-37 Bison, Russia's intercontinental jet bomber, is purportedly capable of performing at an altitude and speed where no fighter in our Air Defense Command can touch it. True, our F-100 Super Sabre could knock the Bison out of the sky, but unfortunately no ADC squadrons are yet equipped with Super Sabres.

For a number of years we've deluded ourselves by thinking that we can build a jet fighter with all of today's safety factors, yet capable of maintaining air superiority from the ground to 75,000 feet or higher. In the future we may have this capability, but until our metallurgists come up with lighter, stronger metals, it will be a physical impossibility. The Russians are smart enough to build lightweight fighters and bombers designed to fight above 50,000 feet. The higher we fly our machines, the greater factor weight becomes. As an example, in Korea the MIG-15 consistently outperformed our F-86 above 35,000 feet. Both aircraft were powered by engines of almost the same power, but the fighting weight of the MIG was almost two tons lighter than the Sabre. The weight factor was the reason they could outperform the F-86 in every maneuver except a terminal velocity dive.

American fighters have gained world-wide fame for their ruggedness because they have been built to withstand stresses, in most cases, of nine times their own weight. To with-

(Continued on page 39)



AUTONETICS engineers have made the earth stand still. This equatorial mount subtracts the earth's rotation, making it possible to detect the minutest angular errors of gyros.

Man has made a flying brain

to think beyond the speed of sound

Some aircraft being built today are too fast for a man to fly alone. Some of them he can't navigate ... one inch off course for an instant can mean a mile off course in a minute. Some of them he can't fight with ... if he sees a target, by the time he presses a trigger, the target has been passed.

What is the answer? Automatic navigation, automatic flight control, automatic weapons control. Gyroscopes more accurate and dependable than any ever built before. Computers the size of a matchbox that do the work of a packing case full of normal electronic equipment. Control systems more complex and more rugged than anything ever needed before. Such is a part of the work—some of the most important of its kind being done in America today—that is going on at AUTONETICS, a division of North American Aviation, Inc.

We'll be glad to tell you what we can—within security restrictions—of the work being done here. If you have a legitimate professional interest in the subject, write AUTONETICS, Dept. F-1, 12214 Lakewood Blvd., Downey, Calif.

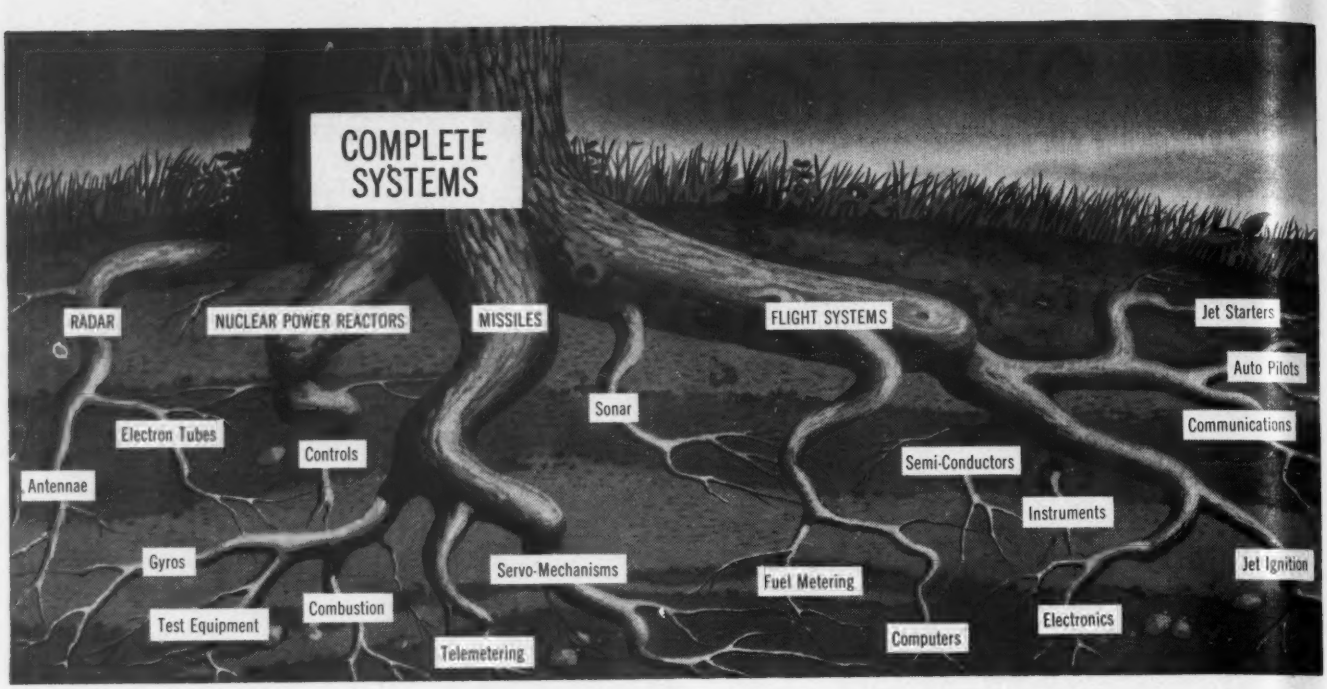
Autonetics

A DIVISION OF NORTH AMERICAN AVIATION, INC.

AUTOMATIC CONTROLS MAN HAS NEVER BUILT BEFORE

A THOUSAND PRODUCTS **Bendix** A MILLION IDEAS

AVIATION CORPORATION



Bendix reliable components + Bendix systems engineering + Bendix proven production ability assure

DEPENDABLE SYSTEMS

The more deeply rooted you are in all the things of which systems are comprised, the better able you are to produce completely dependable systems.

Having produced millions of components, subsystems and complete systems for many years, Bendix Aviation is the logical direction to look for systems to solve many current problems as well as others anticipated. Bendix assets for systems work include:

MAN POWER—An engineering and research staff of over 9000 with a broader range of technical abilities than any in the country.

ENGINEERING AND RESEARCH—Over $80 million was expended on these functions in fiscal 1955.

PRODUCTION FACILITIES—Twenty-four widely dispersed manufacturing divisions located coast to coast employing nearly 50,000 people.

SYSTEMS PLANNING GROUP—Coordinates major systems work, giving you a single, centrally located contact—the Bendix Systems Planning Group, Bendix Aviation Corporation, Fisher Building, Detroit 2, Michigan.

stand these high stresses it has been necessary to make them unduly heavy. The high stress factor is absolutely necessary, to assure crew safety, if the plane is to be used for combat below 15,000 feet where the air is dense and stresses in excess of nine Gs can be placed upon the aircraft. But in the upper reaches of the troposphere, on up to the stratosphere, the air is so thin that it is impossible to put stress upon a fighter that exceeds more than three to five times its own weight.

Advocating that we sacrifice some of our safety at low altitude for performance at high altitude may seem hazardous, but actually it isn't if at low altitude the pilot flies at speeds consistent with structural design. This type of fighter is not an air-show machine. Its sole purpose is to climb into the stratosphere in the twinkling of an eye and destroy an enemy bomber regardless of what altitude the enemy might be flying. If designed to withstand four or five Gs, it'll be capable of flying safely at subsonic speeds at low altitude without danger of structural failure, and at supersonic speeds with a limited degree of safety.

It's obvious that if we equip our air defense squadrons with very-high-altitude fighters, we might be somewhat short-changed in the lower altitudes. True, these lightweight fighters will not have the safety factor at low altitudes that our present air defense fighters have, but they will still be capable of operating in any speed range of an intercontinental bomber flying at low altitude. So, in the final analysis we would have air superiority from the deck to 75,000 feet or higher, but at the lower altitudes the fighter pilot would have to substitute with intrepidity what his aircraft lacks in strength.

No longer are we able to overload our high-altitude fighters with superfluous ground support armament, auto pilot, zero readers and other weight-adding items that are not absolutely essential to the accomplishment of a high-altitude mission. This is an age of specialization, and if we fail to recognize it, and take appropriate measures to prevent our destruction, then we'll have only ourselves to blame should the bombs start falling over here.

In the past we have produced some of the most fantastic flying machines this world has ever seen. To preserve this capability, we must find our own Willy Messerschmitts.

David F. McCallister

LAB PULSESCOPE

by Waterman

MODEL S-5-C

Size: 13" x 16½" x 14⅛"

Booth 158-160 IRE Show, New York.

ANOTHER EXAMPLE OF Waterman PIONEERING...

The LAB PULSESCOPE, model S-5-C, is a JANized (Gov't Model No. USM/24C) compact, wide band laboratory oscilloscope for the study of all attributes of complex waveforms. The video amplifier response is up to 11 MC and provides an equivalent pulse rise time of 0.035 microseconds. Its 0.1 volt p to p/inch sensitivity and 0.55 microsecond fixed delay assure portrayal of the leading edge when the sweep is triggered by the displayed signal. An adjustable precision calibration voltage is incorporated. The sweep may be operated in either triggered or repetitive modes from 1.2 to 120,000 microseconds. Optional sweep expansion of 10 to 1 and built-in markers of 0.2, 1, 10, 100, and 500 microseconds, which are automatically synchronized with the sweep, extend time interpretations to a new dimension. Either polarity of the internally generated trigger voltage is available for synchronizing any associated test apparatus. Operation from 50 to 400 cps at 115 volts widens the field application of the unit. These and countless additional features of the LAB PULSESCOPE make it a MUST for every electronic laboratory.

WATERMAN PRODUCTS CO., INC.

PHILADELPHIA 25, PA.

CABLE ADDRESS: POKETSCOPE

MEMO... Write for details today!

WATERMAN PRODUCTS

MANUFACTURERS OF

PANELSCOPE®
S-4-C SAR PULSESCOPE®
S-5-C LAB PULSESCOPE®
S-11-A INDUSTRIAL POCKETSCOPE®
S-12-B JANized RAKSCOPE®
S-12-C SYSTEMS RAKSCOPE®
S-14-A HIGH GAIN POCKETSCOPE®
S-14-B WIDE BAND POCKETSCOPE®
S-14-C COMPUTER POCKETSCOPE®
S-15-A TWIN TUBE POCKETSCOPE®
RAYONIC® Cathode Ray Tubes and Other Associated Equipment

®T. M. REG.

ARMY H-34 CARRIES 2½-TON HOWITZER—At Fort Sill, Okla., a big Sikorsky H-34, newest member of the Army aviation family, carries a 105mm howitzer. This was the first time an artillery piece of this weight, about 5000 pounds, has been delivered by helicopter ready to fire. The H-34 can airlift 17 combat-equipped soldiers.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

AIRBORNE BULLDOZER—Flying from the escort carrier USS *Siboney*, a Marine Corps HRS helicopter lifts a bulldozer during exercises in the Atlantic. The HRS is a version of the Sikorsky S-55, used all over the world in industry, in passenger, cargo and mail service, and in many armed forces.

LARGE H-34s FOR RCAF—Six new Sikorsky H-34s have been accepted by the Royal Canadian Air Force, the first S-58 types delivered other than to the U. S. forces. The RCAF also flies ten S-55 helicopters, the type operated so successfully under extreme conditions in the arctic, tropics, and remote areas.

IN CALIFORNIA FLOODS—Helicopters went into action quickly and efficiently to save lives and to transport rescue workers, medicine, and supplies in December floods in California, as in Northeast floods earlier in the year. Above, a USAF Sikorsky H-19 of the Air Rescue Service lands in the only spot in Guerneville, Calif., not inundated. Helicopters from the other services also flew hundreds of mercy missions in the disaster. In floods and other emergencies, the versatile helicopter is a key factor in relief work.

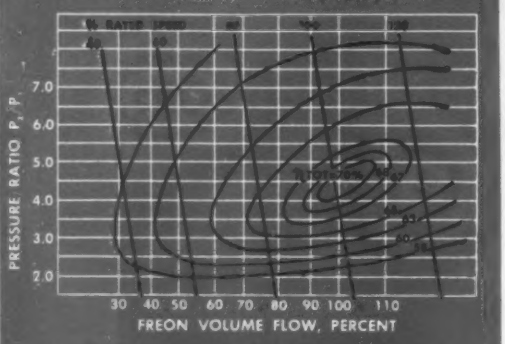
HELICOPTER HISTORY

R-5 LIFTS 18 MEN

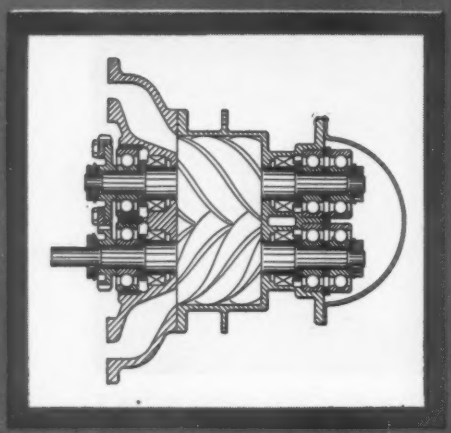
On Jan. 10, 1946, this Army Sikorsky R-5 set a world record by lifting 2538 lbs. Above, it illustrates this capability by carrying 18 men. On the same day it flew to a new altitude record of 21,000 feet, almost doubling the previous 11,243-foot record. It also set a speed record of 114.6 mph. A Sikorsky S-59 now holds the official world speed record of 156.005 mph.

SIKORSKY AIRCRAFT
BRIDGEPORT, CONNECTICUT
One of the Divisions of United Aircraft Corporation

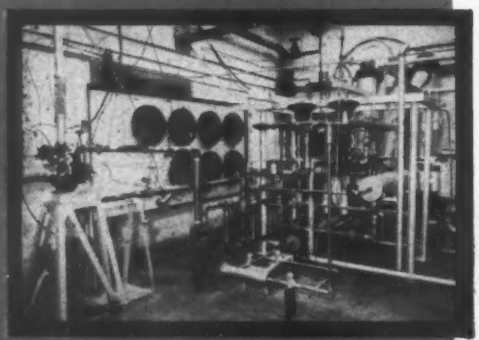
FOR FREON REFRIGERATION



Performance Map Shows Compressor's Efficiency

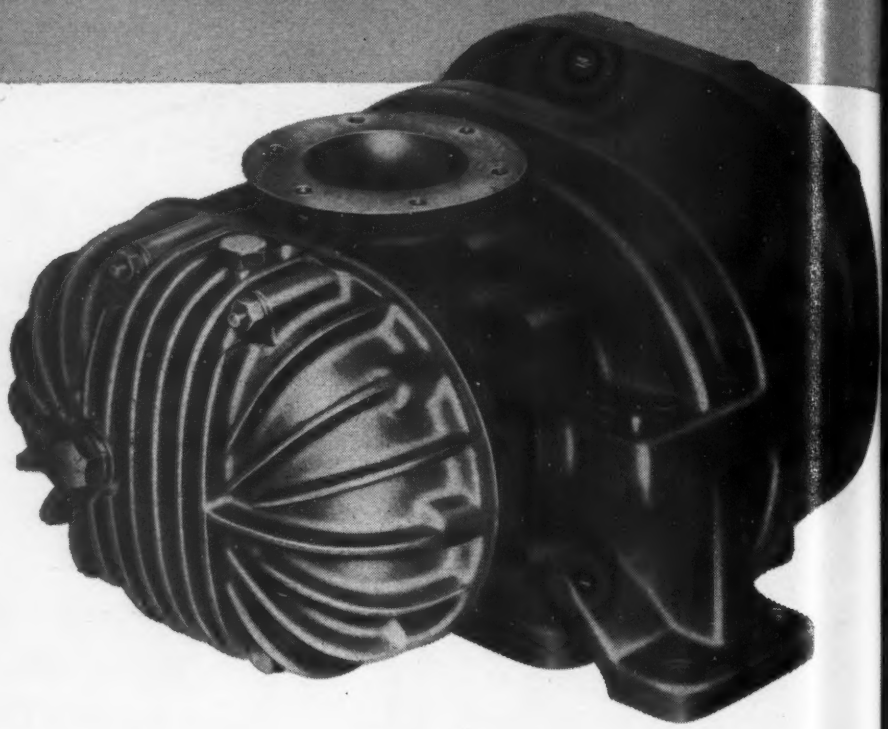


Cutaway View Showing Compression Principle



Installation in Stratos Freon Refrigeration Test Cell

Weight.....7 lbs.
Nom. 10-ton
Compressor



NOW, A HIGH SPEED POSITIVE DISPLACEMENT COMPRESSOR

Stratos' positive displacement compressor is ideally suited for pumping gases against high pressure ratio heads at relatively low flow – volumes such as are involved in freon refrigeration systems for transport aircraft. Compression ratio is built in, avoiding backflow compression, and is independent of speed. The compressor is surge free and simple in construction, requiring no complex valving or control systems. It can operate at high speed – up to 40,000 rpm – keeping unit and drive, size and weight down. Drive can be hermetically sealed electric, turbine, hydraulic or direct from an engine.

Two helical lobe rotors trap the entering gas, compress it in a confined area and deliver it to an exit port at the design pressure. The rotors are of a patented design, with a unique form already proved in a variety of industrial and aircraft applications.

Stratos currently is developing freon refrigeration systems, incorporating this compressor, for use in large transport aircraft. Other applications – such as pressurizing of high altitude aircraft – are being developed.

For further information on this interesting development in compressors write to:

STRATOS

A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

Main Plant: Bay Shore, L. I., N. Y. • Western Branch: 1800 Rosecrans Ave., Manhattan Beach, Calif. • West Coast Office: 1355 Westwood Blvd., Los Angeles, Calif.

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

AIR FORCE
MARCH 1956

WE ARE BEATING OURSELVES

— *right in the Pentagon*

Having abandoned the idea of matching the Soviets in quantity of airpower, we are compounding the error and handing to them, by default, first place in the race for quality

By John F. Loosbrock
MANAGING EDITOR, *AIR FORCE* MAGAZINE

THERE is a saying, repeated often enough to qualify as a cliché, that "the next war is being won or lost now on our drawing boards and in our laboratories." In the sense that we must win the research and development war of today in order to win any military war of tomorrow, this is true.

The grim fact is that we are currently losing this research and development war. But not on the drawing boards or in the laboratories. Our airpower research and development effort is being strangled in the plush front offices of the Pentagon itself. At the decision-making level it is being starved for lack of funds, coordinated into impotency by a bewildering variety of bureaucratic devices, throttled by ultra-conservative "middle-of-the-road" philosophies.

As one scientist has put it, "These people don't realize that in this business you can get hurt standing in the middle of the road."

Having long since abandoned the idea of matching the Soviets in quantity of airpower, we are in the process of compounding the error and handing to them, by default, first place in the race for quality.

How did this happen? Well, as the fellow said, "It wasn't easy." But we managed it. And almost literally. In fact, we have over-managed ourselves into a frightening dilemma. We can only hope it isn't too late to atone for these past errors of commission and omission.

The recent resignation of Trevor Gardner as Assistant Secretary of the Air Force for Research and Development

(Continued on following page)

has performed the valuable service of causing the public, and the Congress, to take a second look at our airpower research and development program. Therefore, it appears that an examination of the Gardner episode would appear to be in order.

In explaining his action, Mr. Gardner stated, "Because of an honest difference of opinion about the importance and scope of the Air Force research and development and guided missiles program in relation to the [Soviet] threat, I have submitted my resignation. . ."

It was to have been Mr. Gardner's job to defend the Administration budget for Air Force research and development now before the Congress. But as he reportedly told a congressional committee shortly after his resignation, "I could not in good conscience participate in a program which had a reasonable chance, in my opinion, of losing the technological race with the Russians."

'At a time when the world is searching for the means to an enduring and honorable peace, it is vital that we in the United States maintain our qualitative lead in aeronautics and the resulting economy of effective airpower. We will do well to remember that to maintain such a lead depends on the vigor and skill with which we press our fundamental and applied research.'

–Dr. Jerome C. Hunsaker, Chairman, National Advisory Committee for Aeronautics.

Mr. Gardner's conscience also would have been troubled by the fact that the budget he was to defend has been misleadingly presented to the Congress and the public as representing a progressive increase in research and development funds for the Air Force.

Statements surrounding the Gardner resignation have since confirmed the facts, first reported on these pages (AIR FORCE, March 1955 and December 1955) that bookkeeping devices have been used to perpetuate this misleading impression; that, actually, the trend in Air Force R&D appropriations is drastically downward. Even worse, the current request, being promoted as the highest figure in the last six years, actually amounts to the lowest appropriation for Air Force research and development in the last six years.

Mr. Gardner had been dissatisfied with our approach to Air Force R&D for some time. But he laid it on the line recently, with a memorandum to Secretary of the Air Force Donald A. Quarles outlining the need for nearly $200 million more for Air Force R&D in the current Fiscal Year 1956, plus $300 million more for Air Force R&D than is contained in the FY 1957 budget now before Congress. And he spelled out the need in chapter and verse—project by project.

Not content with presenting the memo as one man's opinion, before Mr. Gardner went to Secretary Quarles he secured coordination from Lyle Garlock, Assistant Secretary of the Air Force for Financial Management, Gen. Nathan F. Twining, AF Chief of Staff, Lt. Gen. Donald L. Putt, Deputy Chief of Staff for Development, Lt. Gen. Frank F. Everest, Deputy Chief of Staff for Operations, James H. Doolittle, Chairman of the Air Force Scientific Advisory Board, and Dr. Guyford Stever, Chief Scientist of the Air Force. None of these men expressed opposition to the Gardner memo.

Contrary to published reports, this statement of the problem did not request more money or higher priority for ballistic missiles—either intercontinental or intermediate range. Mr. Gardner himself admits that currently there is no lack of funds for these projects. The memorandum covered Air Force research and development requirements in many vital fields—bomber and fighter prototypes, revolutionary advances in aircraft propulsion, electronics, weapons, countermeasures, etc.—projects which are starving for lack of money to stimulate and exploit technological breakthroughs. If anything, it concentrated on the need to exploit such breakthroughs in the design and propulsion of manned aircraft to progressively strengthen the force in being. This fact has been almost completely overlooked in the public preoccupation with missiles. Indeed, the Gardner memorandum was prompted, in large part, by the squeeze-out of other essential projects when heavy concentration of Air Force R&D expenditures of high priority missiles pushed against a tight budgetary ceiling.

Nor is it true, as often reported, that Secretary Quarles disagreed with the basic facts in the Gardner memorandum, or that he flatly turned down the request for more R&D money. After discussing the memo with Defense Secretary Charles E. Wilson, Mr. Quarles did point out that the more practical course would be to present the request in the form of an item-by-item justification to the Department of Defense through the man in Mr. Quarles's old job—Assistant Secretary of Defense for Research and Development Clifford C. Furnas. Mr. Quarles was later supported on this question of procedure by General Twining and Mr. Garlock.

This deep concern over procedure is the heart of the basic R&D conflict in the Pentagon, a conflict which goes beyond personalities. Mr. Quarles had sat in the Secretariat of Defense just a year before and he knew that only an item-by-item justification could penetrate Mr. Wilson's tightly-knit fiscal and administrative defenses, despite the delay this might cause.

Thus we come to the nub of the problem—the system, the Department of Defense system, to be precise. It is a system of interlocking committees, of endless reviews, of watchdogs and counter-watchdogs. It is a system which places a premium on foot-dragging and on the ability to find some small thing "wrong" with a major program, so as to justify either a "stop order," or Department of Defense staff interference with the program, or both. It is a system which heavily penalizes imagination and ingenuity. It is a system which places 2,800 persons on the Department of Defense level in a position to say "no," leaving only a handful who can say "yes" with finality, and no one at all who ever says "do more, do it faster."

What the system accomplishes is hard to say. It saves money in any given fiscal year, perhaps. It is one way of tackling what is the biggest, most complex business in the world. But it may well cost us larger sums in the long run—and cost us even more than money.

In his press conference following the Gardner resignation, President Eisenhower said our missile program "is being researched and developed as rapidly as it can be done in this country, so far as my experts and my people in the Defense Department tell me."

A year before, these same "people in the Defense Department" had told the President that the budget then being considered had the unanimous approval of the Joint Chiefs of Staff. We now know from General Ridgway that this was not the case. Nor is it the case with the airpower research and development portion of the FY 1957 budget—as the Gardner resignation has brought to light.

The President knows, from personal experience, what far-reaching military effects a technological breakthrough can produce. In his book, *Crusade in Europe,* General Eisenhower had this to say about the V-2—the new weapon of that day:

"It seemed likely that if the German had succeeded in perfecting and using these new weapons six months earlier than he did, our invasion of Europe would have proved exceedingly difficult, perhaps impossible. I feel sure that if he had succeeded in using these weapons over a six-month period . . . OVERLORD (the main cross-channel assault) might well have been written off."

Technology has taken a quantum jump or two in the intervening years, and even six months is no longer a valid measure of safety.

The President also said, only a few weeks ago, regarding our current R&D progress, that "there are limits to what you can do in research and development . . . there are only so many scientists, there are only so many channels you can pursue, and indeed, one of the things you have to watch is this—don't try to develop too many at once or you get in each other's way and you block them all through the confusion and demands you make on the scientific pool . . ."

This statement reflects a popular viewpoint of his "people in the Defense Department." Implicit in the view are two basic misconceptions. The first is that a shortage of engineering and scientific manpower makes it impossible for us to profitably spend more money than we are now spending on research and development. The second is that our research and development effort is in danger of being diluted by striking off in too many directions. Let's take these in turn.

The myth of the shortage of scientists and engineers for national defense work dies hard. It should have been shot down once and for all by the recent report of the National Science Foundation. But the myth still persists. The fact is that the Air Force currently is using less than five percent of the scientific and engineering personnel in the United States today. And the National Science Foundation points out that the number of scientists and engineers is growing proportionately more rapidly than either the over-all population or the labor force. The estimated total number of scientists and engineers has increased from about 260,000 in 1930 to approximately 850,000 in 1954.

The scientific manpower shortage theory thus just won't wash. The talent is there. True, some of it might have to be diverted from color television research or looking for new automatic ways to make your car windows roll up and down. But this would be a small price to pay for leadership in the weapons technology race.

Now let's look at the matter of diluting our R&D effort by too many projects. We have already spoken of the maze of boards and committees through which a new idea must pass before it gets the good budgetkeeping stamp of approval. This process alone places strict limitations on the number of projects for which money is requested and obtained.

Let us consider, too, the matter of ceilings on appropriation requests and expenditures, which we have discussed in past issues of this magazine and which will be discussed later on in this article. Operating under tight fiscal ceilings makes it mandatory that the Air Force concentrate its R&D money and effort on relatively few high-priority projects. This is certainly true at the present time.

This leaves many avenues unexplored, restricts the opportunities for technological breakthroughs, and limits the variety and effectiveness of the hardware available to those who must plan our future strategy. It might be good accounting but it isn't good research.

A third obstacle, implicit in the first two, is a question of attitude. Either you believe in research or you don't. Mr. Wilson once laughed at the desire to find out why potatoes turned brown, despite the fact that this bit of information has saved the armed forces thousands of dollars. This attitude is understandable, perhaps, coming from a man who rose to greatness in an industry where the quantum jumps, so to speak, had been taken when he was still in knee pants. It is difficult to make the adjustment from a background of mass production and conservative efficiency to an environment where technology is moving at a dazzling pace. Evidently, Mr. Wilson has not yet been able to make this adjustment.

One result of his approach is seen in the "fly-before-you-buy" philosophy of aircraft procurement—now an integral part of the Pentagon system. As defined in the semi-annual report of the Secretary of Defense for the period ending June 30, 1955, "fly-before-you-buy" means that "mass production of new types of aircraft is currently being delayed until tests have fully demonstrated the technical soundness of the new model, thus saving hundreds of millions required for extensive modification under former practices."

Thus "fly-before-you-buy" does save money—today.

(Continued on following page)

SHORTAGE OF SCIENTISTS—A MYTH

Using 1930 as a base, the total population has increased during this period by thirty-two percent, the number of engineers by 202 percent and the number of scientists by 335 percent.

In 1947, the President's Scientific Research Board estimated that in 1930 there were about 46,000 scientists in the country, and about 92,000 in 1940. By January 1954, the US Office of Defense Mobilization estimated that there were approximately 200,000 scientists in the country.

Engineers totalled 215,000 in 1930, 286,000 in 1940, and 534,000 in 1950. Allowing for deaths and retirements and for new entrants into the field, the National Science Foundation estimates that there were as many as 650,000 engineers in the country by mid-1954.

Of the total number of scientists in the 1951 National Scientific Register, fifty-eight percent were employed in private industry, twenty-five by educational institutions and seventeen percent by government agencies. Another National Science Foundation estimate, based on the census and other sources, found that in 1950 eighty-eight percent of the engineers were employed by private industry, ten percent by government agencies, with the remaining two percent by educational and other nonprofit institutions.

But it is costing us dearly in precious lead time (AIR FORCE, February 1955), and it tends to hamstring our military effort with weapons that become obsolescent before they get into production.

A case in point is that of the B-47. Under a fly-before-you-buy approach we would have lost a minimum of two years in acquiring the airplane which currently represents our sole element of aircraft superiority over the Soviets.

General "Hap" Arnold clearly saw the dangers of the ultra-conservative approach to airpower research and development many years ago, when some aircraft engine people were calling jet propulsion a "passing fancy." It is a credit to General Arnold's foresight that, despite this advice, he ordered Wright Feld to begin work on jet propulsion in 1941 and personally ordered one of Sir Frank Whittle's early jets to be shipped to the United States from England.

General Arnold knew there were two ways to win a war—by overwhelming the enemy or by outsmarting him. We overwhelmed the enemy in World War II, but largely because, as General Eisenhower has pointed out, the Germans were six months too late with the V-2.

***'The Communists are making scientific and technological advances at a faster rate than we. The fact that the Communists can put not one, but several projects on a crash basis indicates a tremendous capacity for research and development. I add that this also indicates a disregard for cost and/or safety factors, and willingness to gamble.'*—Lt. Gen. Thomas D. White, Vice Chief of Staff, US Air Force.**

General Arnold wouldn't have been happy with our research and development progress in the years since his death. Our complacency over our atomic monopoly became a myth which was quickly exploded by the first Soviet A-bomb. We went into Korea with no new aircraft prototypes because of lack of R&D money. We were disturbed by the numbers of MIG-15s the Soviets proved able to turn out of an "ox-cart economy." But we took refuge in "quality" then as we continue to do now.

The President has used quality as a measurement of our superiority over the Soviets. Mr. Wilson has used it, not so much as a pillar of our strength, but as a column behind which to hide when pressed for more definitive answers to questions concerning our military position vis-à-vis that of the Soviet Union. Our military leaders have clung to it as a last straw of hope, while other elements of military strength have been dwindling. We have been hoping to counter numbers with advanced weapons, sprung, no doubt, like Minerva, from the brow of some scientific Jove.

Let's look at our budgetary record—spanning six years and two political administrations—designed to buy this precious quality.

In Fiscal Year 1952 the research and development portion of the Air Force budget was $511 million. In FY 1953 it jiggled up to $606 million, but in FY 1954 it was back down to $511 million. Each of these years the Air Force requested some $200 million additional, requests which never got by the Secretary of Defense's pruning hook.

Contrast this level of R&D funding with the recommendations of the AAF Scientific Advisory Group, forerunner of today's Scientific Advisory Board. At General Arnold's request this group of distinguished scientists, headed by Dr. Theodore von Karman, put together a blueprint for the Air Force's future development.

Their report said, "If, in peacetime, fifteen to twenty percent of the sum spent during war years were allowed for the total expenditures of the Air Force, the amount required for research and development should constitute from twenty-five to thirty-three percent of the total Air Force budget."

The record shows that we have kept this research and development funding deep in the basement. We provided only four or five percent of the total budget in each fiscal year—less than one-sixth of the minimum suggested by the scientists in 1945.

We're getting no better fast. In Fiscal Year 1955, research and development funds slipped to $499 million. The following year saw the introduction of the great juggling act with R&D money. On paper the funding went up $71 million, to $570 million. But the increased figure was accounted for, in large measure, by a new bookkeeping device which moved over $28 million previously carried under procurement and $110 million previously carried under maintenance and operations, thus leaving only $432 million for R&D, or $67 million less than the previous year.

This year the same financial shenanigans are still in force. Of the $610 million ostensibly ticketed for R&D, only $421 million is actually available—the difference being an accounting maneuver.

This combination of unrealistic fiscal ceilings, red tape and misinformation represents the Pentagon climate which led to the resignation of Mr. Gardner. The battle of philosophies will go on.

At the time of his resignation, Mr. Gardner said that he was preparing, at Mr. Wilson's request, a full report on Air Force research and development. We can only hope that this report will penetrate to the highest decision-making levels of our government.

Finally, it remains to be seen whether the Congress will follow up its current and planned investigations with budgetary action to salvage our airpower research and development effort from its pitiful plight.

Fortunately, Mr. Gardner has made it clear that the conflict in viewpoints goes far beyond the matter of half a billion dollars for research and development. He has testified to his dissatisfaction with the entire Air Force budget and, indeed, confirmed the fact, as we reported last month, that the over-all Air Force requirement adds up to almost $4 billion more than the $16.5 billion being requested by the Administration for the next fiscal year.

Mr. Gardner also has highlighted his dissatisfaction, shared by many responsible people in the Air Force, with our "business-as-usual" approach to B-52 procurement for General LeMay's Strategic Air Command. He says our B-52 production could be tripled with little sweat, and must be to preserve the superiority of our force in being.

Adding it all up, Mr. Gardner recently told a nationwide audience that the FY 1957 budget "guarantees us a second-best Air Force."

As we have been saying for many months, we doubt if this is the kind of guarantee that will reassure the American public, even though it may bear the Administration's Good Budgetkeeping stamp of approval.—END

WHICH WAY'S UP?

Lear-Romec
all-attitude fuel
booster pumps
couldn't care less

. . . USED IN CESSNA T-37, USAF'S NEWEST JET TRAINER

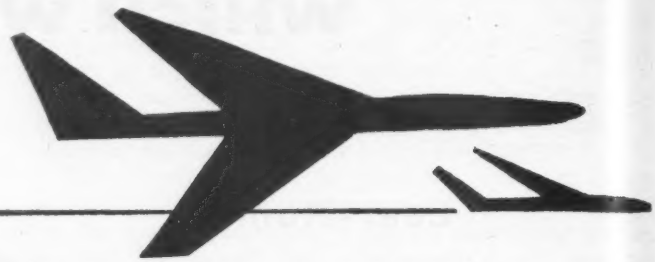
LEAR

Complete details on all-attitude submerged-type fuel booster pumps write LEAR-ROMEC DIVISION, Abbe Road, Elyria, Ohio

RO-19

THE AIR FORCE ASSOCIATION'S

jet age CONFERENCE



Perhaps the greatest barrier to our entrance into the Jet Age which is upon us is public understanding of the issues involved. In Washington, D. C., on February 3 and 4, AFA's Jet Age Conference met to attack this barrier with more than 1,500 registrants from every segment of American airpower. Except for national conventions, it was the largest, and most successful, event ever sponsored by the Air Force Association. It marked the latest in a succession of such affairs, which represent an important part of AFA's Industrial Associate program. Registered at the conference were 860 individuals representing 300 companies, 315 military and civilian government personnel, sixty members of the AF Reserve and Air National Guard, fifty-seven representatives of twenty-five different organizations having aviation interests, ninety state and municipal aviation officials, 135 local, state, and national leaders of the Air Force Association, and thirty-four members of Congress. Sixty-seven newsmen from the nation's leading newspapers, wire services, magazines, and radio and television networks spread the conference message to all corners of the land. Luncheon on the opening day was addressed by AF Chief of Staff Gen. Nathan F. Twining, with AFA Board Chairman John R. Alison as toastmaster. The Saturday luncheon speaker was Secretary of the Air Force Donald A. Quarles, with AFA President Gill Robb Wilson taking over the toastmaster chores. Jimmy Doolittle served as moderator throughout all conference sessions. For the benefit of those who could not attend, and for the convenience of those who did, there follows a complete report on what transpired, beginning with the opening remarks (below) of Gill Robb Wilson, President of the Air Force Association.—The Editors.

SETTING THE STAGE

Gill Robb Wilson
PRESIDENT, AIR FORCE ASSOCIATION

THE PEACE of our world is weighed in terms of comparative airpower. Survival has become an air science.

And now, with revolutionary impact, the advent of turbine power is advancing our military weapons and civil aircraft into fantastic ranges of performance. This development has sharpened the race for survival. If American airpower is continuously to stave off the declared aggression of the Soviet, we must drive ahead with ever-increasing momentum into the jet era, whose operational advent was a scant ten years ago.

But the road ahead is not free and clear. Jet propulsion has multiplied the attendant annoyances of airpower—emphasized the obsolescence of current facilities—magnified the hazards of crowded airways—and imposed weighty economic considerations.

In the normal course of events, and in a normal world, these matters would adjust themselves in time. But this is not a normal world, and the role of time as the great healer could be reversed to time as the great destroyer.

If military airpower were more than superficially divisible from civil airpower, we might isolate its urgency, establish it remotely and depend on time to mitigate civil irritations and annoyances. But airpower is not divisible. The treaty makers of World War II made this mistake and thereby wrote the inevitability of World War II into the Treaty of Versailles.

Such is the case that, in driving ahead into the jet era in pursuit of that flickering hope called world peace, we must invoke not only scientific genius, but public understanding and approval. We will toil in vain unless we toil in partnership with a knowledgeable public. We must meet and solve our dilemma in the American way, even though at times it seems the hard way.

To us, in aviation, certain truths appear self-evident: that the decisive medium of international discipline and commerce is the air ocean; that airpower includes the

sum total of a nation's aeronautical development, inclusive of its public opinion; that what military aviation is to the business of security, civil aviation is to the security of business; that for defense there are no geographic perimeters but only those perimeters which define the aeronautical stature of a nation. These studied conclusions all seem very clear to us.

But we must remember that the American lay public has had no background from which to reach this understanding. Our public education has been scantily geared to produce air-wise youth. Our higher education has not progressively turned out adequate cadres of scientists and engineers and technicians. Airport development has been a bone of contention in the vast majority of municipal bodies. Never have we had a clear cut and comprehensive national air policy. Our aviation literature has been lamentable and sparse. Government itself has not been forehanded in generating incentive for youth to enter aviation industry and science but by diverse procurement policies has made this area a land of peaks and valleys. And furthermore, the accumulated opposition to aviation which characterized bygone years has produced confusion in public concept and catered to disgruntlement—a bitter smog through which we now must navigate on our way to survival.

So we cannot fairly hold that aviation's partnership with a knowledgeable public has ever been given a trial. If this were Russia, it might not matter. But this is the United States and we propose to do things in the American way—face up to realities together and work out our common destiny on the broad front of national consciousness.

For just such purposes as this the Air Force Association was originally called into being, not as a creature of the Air Force, but as a medium of the people for discussion, diagnosis, and analysis of air affairs. Only an enlightened people can be a wise people. And not that we ourselves can claim wisdom, but that out of common cause approached in a spirit of patriotism, wisdom will come. To this end you have been called together from every facet of aviation and from related walks of life. This conference is designed as a pebble cast into a broad pool, whose concentric rings spreading outward will set in motion the processes necessary to universal understanding. Be not disturbed if we have honest disagreements. There are no easy answers to the problems of the Jet Age. Nor do we yet so much as know all the questions. But this we do know—we cannot survive in complacency.

It is frequently pointed out that all radical progress is accompanied by considerable byplay of selfish competition and public fretfulness. I have made broad studies of this subject and know this to be the case. Yet, I cannot agree that present conditions are therefore the more tolerable. That canal operators had to struggle with stagecoach companies and tavern keepers did not involve the fate of humanity. That people rioted in the streets to keep the railroads out of Philadelphia lest they "annihilate human rights" was not world-shattering. That the first horse-car drivers in New York chained themselves to their seats to avoid arrest, and removal by city fathers was but whimsical. That a great metropolitan newspaper resigned itself to the advent of streetcars with the comment that "human life is really of little value nowadays" was mere editorial persiflage. That the press and pulpit fretted because bicycles allowed free-wheeling young ladies to outdistance their chaperones did not cause nations to shudder. That embattled farmers scattered glass on the roads to stop automobiles did not threaten the sovereignty of the American flag. Time took care of all and sundry such friction and provincialism on the trail of progress.

But today we are under an urgency our forefathers never knew. If this fact be not evaluated properly in relation to the whole problem of adjusting to the Jet Age, while at the same time making that adjustment as painless as possible, there will be nothing left to adjust.

Incident after incident might be cited to show the gravity of our problem. For example:

A jet trainer strikes a house in a California city. Women and children picket the nearby airport. An aviation manufacturer is forced to move. The city council demands an immediate investigation. A million-dollar lawsuit is filed. A jet-equipped Air National Guard unit is pressed to leave the area.

A resident of a Pennsylvania city, living at the end of a runway, files suit to stop planes from flying over his house on the grounds that his privacy is being invaded.

In an eastern state the anti-noise campaign of a minority group climaxes in a resolution, passed unanimously by the lower house of the state legislature, demanding removal of an air defense unit of jet fighters.

In one of our great midwestern cities, after organized public pressure has forced the issue, the Air Force begins to relocate an air defense base at a net cost of $45 million of defense funds.

Not far away, in Michigan, a nation-wide air defense exercise of the Air National Guard comes and goes with a unit of jet fighters grounded by a court order granted to a couple living near the air base. I might multiply these hundreds or scores of times.

These are but a few of the case histories, each of recent origin, in Air Force files. The list is long. The aircraft industry has its list, and a file of pending law suits. The airlines, struggling to keep major air terminals open, have their own lists, without having any jet aircraft on hand.

I am not unappreciative of silence, but there is a kind of silence which I too often have witnessed around the world—the silence of defeat and desolation.

I am not unappreciative of individual comforts, but I have seen them, too, perish in national devastation.

Nor am I unappreciative of danger from overhead and it must be minimized as much as possible, but I must think also of danger faced by those in the cockpits although they disturb my quiet in pursuit of their missions.

And in my own mind I must draw a distinction between those who live in the old homestead and are invaded by jet noises and those who develop housing projects adjacent to existing airports and then organize protests against the nuisance or danger of planes in the vicinity.

Now I do not know at this moment how the word of truth may be rightly divided among the many conflicting interests which are blanketed by the Air Age. To what degree science may contribute, or law, or the exercise of human decency, patriotism or judgment, is still to be resolved.

I judge we might wisely have a law permitting the Air Force to relocate certain bases with funds derived from the sale of certain existing bases.

I am sure science will have better and better solutions to noise abatement. I look to the aerodynamicists for such aircraft control at slow speeds as will enable a pilot to avoid critical crash landings. I think traffic control can be established to automatically prevent air collision. I believe the private airplane can be so designed as to be a routine tool in the hands of the individual. I feel that an adequate system of air education can ultimately inform our people and inspire our youth to seek schooling in the sciences. I judge zoning laws for air facilities can play a part.

But all of this is conjecture. What I know without equivocation is that we are under great urgency, but that so were our forefathers when they declared their independence and wrote their Constitution, yet, in the spirit of cooperation, wrought their salvation.

In this spirit then, welcome to this Jet Age Conference.

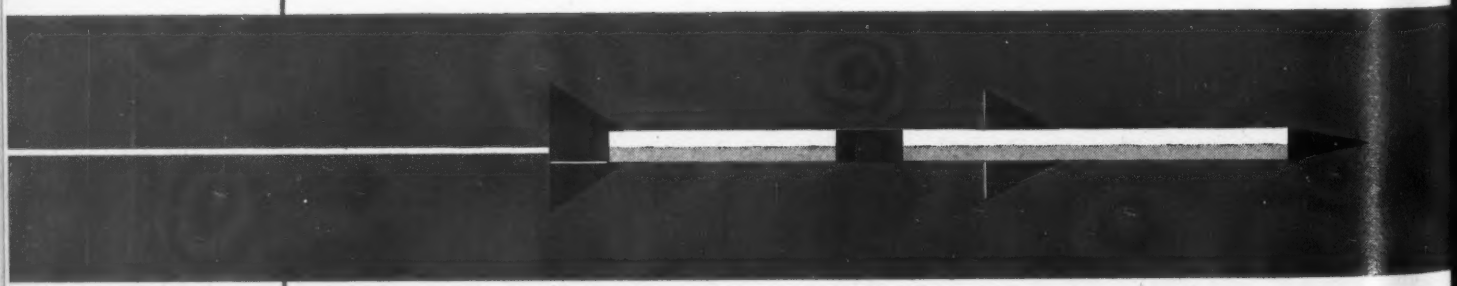
Computation...the heart of any defense system...is Burroughs business

Computation is our business at Burroughs—has been for 70 years.

In that time, we have consistently pioneered faster, more efficient business accounting and computing machines. Today, Burroughs devotes a large part of its skills and facilities to computation and data processing for defense . . . to systems requiring electronics for guidance, detection and interception.

This is why the Armed Services rely on Burroughs experience and resources to see defense projects through from scratch—from research to development, to engineering and tooling . . . to production, testing, field service and training.

We welcome all inquiries relating to defense contracts in these areas of our proved capabilities: instrumentation, control systems, communications, electronic computers and data processing. Call, write or wire Burroughs Corporation, Detroit 32, Michigan.

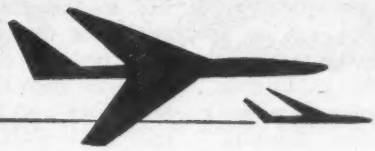


Burroughs

BURROUGHS INTEGRATED DEFENSE FACILITIES INCLUDE:
Burroughs Corporation plants in Detroit and Plymouth, Michigan
Burroughs Electronic Instruments Division, Philadelphia, Pa.
Haydu Brothers of New Jersey, Plainfield, New Jersey
Control Instrument Company, Brooklyn, New York.
Burroughs Research Center, Paoli, Pa.

Looking to future expansion, Burroughs invites inquiries from qualified engineers:

the jet age



Military Requirements in the Jet Age

Gen. Earle E. Partridge
COMMANDER-IN-CHIEF, CONTINENTAL AIR DEFENSE COMMAND

THIS morning, I want to outline the US Air Force requirements in the second decade of the Jet Age. I want to talk about two broad areas—first of all, what we need in the way of air bases, and how we plan to use them. Secondly, I want to talk to you about air traffic control, because it is a real problem. These are not new problems for the Air Force or the Civil Aeronautics people either. They are old problems and they are pressing in on us much more vigorously than before. The Air Force recognized it, and a couple of years ago it appointed a committee headed by Maj. Gen. Herbert B. Thatcher. They worked on the problem, and they came out after a year with this paragraph:

"The committee has been impressed throughout its study by the pervasiveness of two basic influencing considerations. First, the conflict between communities and air base operations is not simply an Air Force problem. It is a problem affecting national policies and the national economy as well as national defense. It applies to the civil populace, to Congress, to the other armed forces and to industry, as well as the Air Force. United States Air Force air base utilization is a national problem and there must be a *national* solution. Second, the answer to the problem must be effective in resolving present conflicts as well as effective in preventing future ones. An effective long-range solution will be cheaper and will give better defense and will be more acceptable than a series of temporary solutions."

With this much background, let us jump off the deep end into a discussion of the air base problem and the chief offender—the airplane. First of all, let us look at this airplane to see what kind of performance we are talking about.

The turbojet aircraft we are about to have and the ones we have now are of extremely high performance. They are of high speeds, and we are going to be dealing with speeds of Mach Two, and we already have two supersonic fighters in the inventory. The take-off speeds of these types of aircraft is increasing as the years go by. At the present time, the fighters are touching down at 150 knots at least. They fly the pattern at 200 knots and above, and even when they are coming over the fence, they are using a lot of power in their approach; they are making better than 175 knots. In other words, they come over the fence at about 175 and might hit going about 150. These aircraft are essentially high-altitude aircraft. They take off, climb to altitude, do their mission and descend swiftly. They must climb in the shortest possible time because the fuel consumption is very high. These aircraft have a very high rate of ascent and descent. The fighters we have coming along will climb subsonically to 35,000 feet. After that, they will go to Mach One, Two or Three, whatever it is to carry out their mission—40,000 feet a minute or better. This is eight or nine miles a minute straight up.

Let's take the B-52 as an example. When you put the gear down and the flaps up, and so forth, the airplane comes down in a very steep angle. You would fall out of the seat if you were not strapped in. The speed is 375 knots or thereabouts. This B-52 is a big airplane, and, in the descent, the rate-of-climb indicator is no good at all. It only goes to 6,000 feet a minute, and you are making 12,000, 15,000 or 18,000 feet a minute on an angle.

In addition to that, the airplanes are getting heavier. Our fighters are weighing 25,000 to 40,000 pounds heavier and the weights are going up. The B-52 weighs about 400,000 pounds and it is still growing. The performance of the airplane is made possible by the very great power available to us in turbojet engines. We are not satisfied with that, however; we must couple on the back of the engines an afterburner. Even when you have a single engine with an afterburner, you have a terrific controlled explosion.

We really do not have any good measures for evaluating the sound or conveying from one person to another the level of sound to be expected. We are talking about decibels, which is a measure of sound as it appears to the human ear, the sound which you can distinguish as increasing or decreasing. . . . It would take a Rip Van Winkle to sleep through . . . the forty to eighty decibel area. [It is] the forty to eighty-six area that wakes up people on the end of the runway, but when you get to the F-86G with its afterburner, you are up almost to 140 decibels. The F-102 is slightly over 140, and the B-52 is

(Continued on following page)

up over 150. It is intolerable to the human ear when you get close to it.

In addition to the noise we get out of the engines, we also get some noise out of the aircraft itself. . . . Flights at low altitudes at supersonic speeds are not only noisy, but they are dangerous for things on the ground. You will probably recall the exhibition flight put on at Palmdale, Calif., which damaged glass and so forth. Real damage can be done on the ground, so we have to keep the planes up in the air. The sound comes back to the ground even though the flight is made at very high altitude.

There is one other aspect of the hazard. Thus far, we have talked about performance, high speeds, high weights, nuisance, noise, and hazard. But we have not talked about the munitions.

The Air Defense Command—in fact, all of the Air Force—is designed to carry munitions on a mission. The Air Defense Command itself, of which I am head, flies all over the country. We have fifty-five different bases with aircraft that are armed. They are ready to shoot on every tactical mission. They are not armed with machine guns; they are armed with rockets which are 2.75 inches in diameter and each explosive blast is equal to a .75 mm shell. In the F-86D, we have twenty-four of these; in the F-89 you have 104, and we must store these on the base in our normal operations. It must be obvious to you that

---

GEN. EARLE E. PARTRIDGE, *Commander-in-Chief, Continental Air Defense Command, was born in 1900 at Winchendon, Mass. A graduate of West Point (1924) he earned his wings, and in 1932, attended Command and General Staff School. In 1942 he became a member of the War Department General Staff and later served as Deputy Commander of the 15th AF. He was appointed Deputy Commander of the 8th AF in England and returned to AF Hq. in 1946. He took the 5th AF to Korea in 1950, later returned to the US to command ARDC. In 1955 he took over joint command of ADC and CADC.*

---

if we can get better protection for the country by using atomic weapons, we are going to use them. That means in the days that lie ahead—and they are not too far ahead—we will have atomic weapons storage at your various airports, and the various airplanes you see flying around on missions will be carrying atomic weapons. We are going to do as much as we can to make the aircraft, weapons, and procedures safe, but the hazards are still there.

In the light of these hazards and these problems, what kind of an airfield do we have to have? We had the Thatcher Committee and another distinguished group put together by the Assistant Secretary of Defense studying this. They came up with these requirements: For a single-engine jet aircraft, we need a runway 10,000 feet long and 200 feet wide. For multi-engine jets, we need at least 11,000 by 300. The taxiways and parking area as well as the runway must be of heavy pavement and wide in proportion. They must have blast aprons along the sides to keep from blowing away the shoulders. These runways, as long as they are, must have overruns at least 1,000 feet on each end. The British call them overshoots. The figures of 10,000 and 11,000 which I am quoting for you designate only sea-level conditions. If you were to go to high altitude or operate in hot weather, you need longer runways—considerably longer runways.

In addition to the airfield itself, you need a relatively clear zone, one free of communities and industrial facilities, on the extensions of the runway. The ideal situation would be to have one seven miles long and four miles wide on each end of the runway. It must be obvious to everyone here that you could not go to Long Island and buy a strip of land sixteen or seventeen miles long and four miles wide. However, we do think it is possible to have zoning in the extensions of the runways so that we will avoid these congested areas which now form at the ends of the flying field where the danger from a forced landing is grave.

These two committees felt the airfields should be about fifteen miles, at least, from the nearest large community. Fifteen miles is required to get the traffic patterns which are essential to safe flight. It seems a long distance, but that is the distance they recommended. It is obvious to you, I am sure, that these are ideal requirements, and we do not meet them. We have to start with the present situation, and I am sorry to say that I have to operate my fighters on eighteen airports which are shared with civil and municipal operators. There are several airports or municipal airports—eighteen of the fifty-five. Very few of our airfields are 10,000 feet long. Most of them are far less than that, and they lack the clear zones at the ends which are essential for safety and for the elimination of the noise hazard. There is a steady encroachment on these zones at the ends of the fields by the civilians in the adjacent communities.

Recognizing that we cannot go from where we are to where we would like to be, the Air Force has, however, adopted a three-phase program.

We have a scheme of public education. We are working on scientific, operational, technical developments, and we are working on the physical movement of the base to better areas.

Let's take the physical removal. This is the solution that the communities usually come up with: Get out of here; go somewhere else. But it is an expensive solution and one with which we have great difficulty in adopting, not only from the expense point of view but for other reasons as well. If you pick up a base here and move it over there, you take your problem right along with you, because before you arrive, the real estate people have subdivided all of the land, and they have sold lots all over the place, and you do not have time to zone. They get the word, as the Navy says, before we do. Therefore, the problem of moving out of the community and moving to an adjacent area which is relatively free of civilization is a stop-gap and is not recommended.

We are having better luck, however, with our public relations program than we have had in years gone by. Throughout the Air Force, instructions to the base commander are such that he must get in touch with the community. He joins the Chamber of Commerce, the Kiwanis Club, and so on, and he gets on the bread-and-butter circuit—he eats chicken and talks to everybody who will listen to him. Some of my base commanders are spending half their time talking to the community. It would be safer if they would come home to their flying, but I have to go on with this public relations program. We have other meetings. We have some movies.

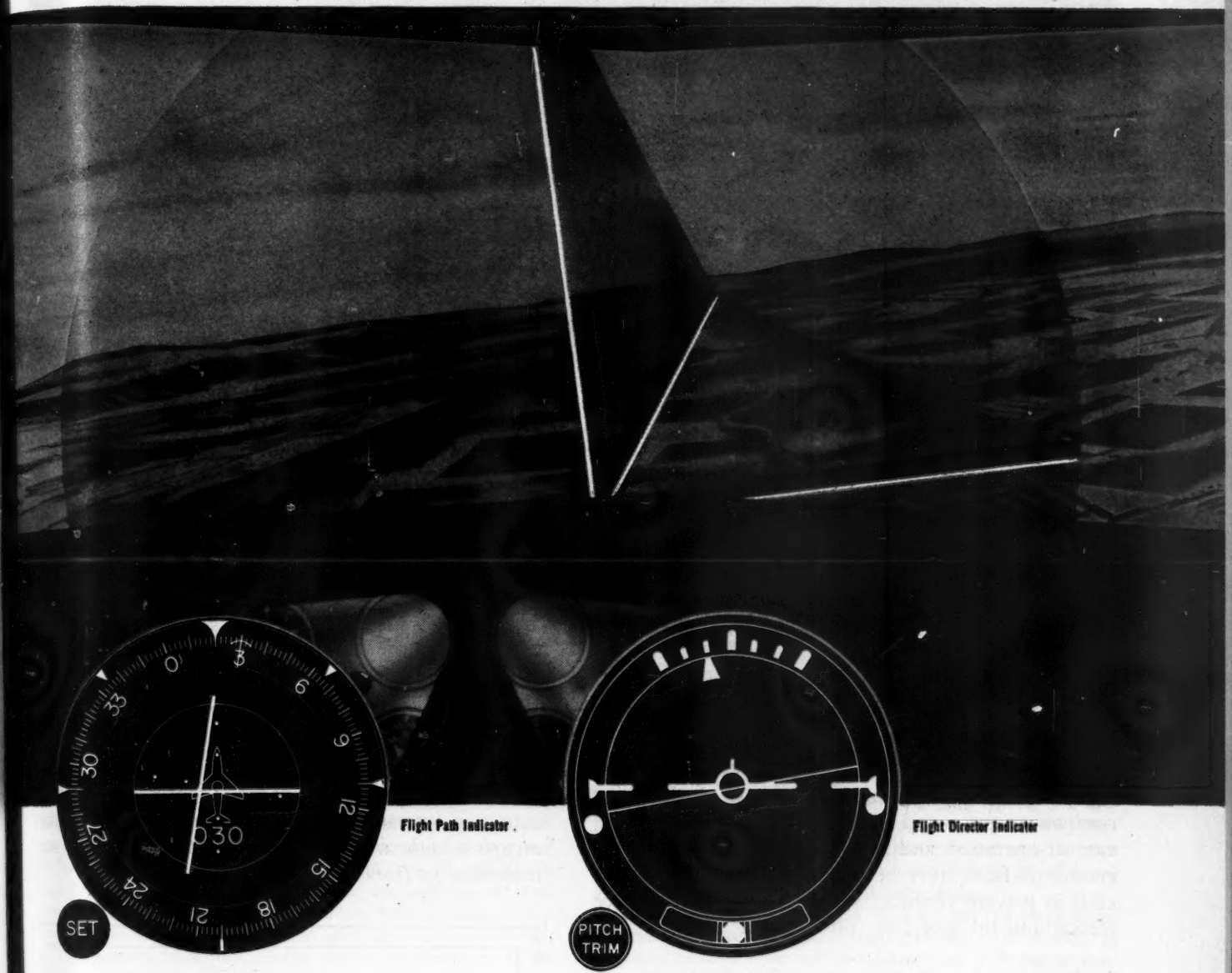
We work on the press to try to stress the safety angle, the heroism of the pilot who stays with his aircraft, and so on, and we are having good luck, but it is a long-term process which takes a lot of effort—more than we can afford to give to it.

In the field of research and development, a lot of work has to be done. It is possible to make the jets less noisy. Certainly we can do a great deal about building diver-

(Continued on page 55)

Now—A FLIGHT DIRECTOR SYSTEM BY Bendix

FOR MILITARY AIRCRAFT AND COMMERCIAL TRANSPORTS



Flight Path Indicator

Flight Director Indicator

Today's Bendix Flight Director System reflects *tomorrow's* requirements for a true director of flight control with simplified, consolidated display of actual performance. For proof just check these features: √ Consolidated display of flight commands and performance on just *two* indicators √ "Natural reaction" type of command presentation √ Pictorial presentation of aircraft position at all times √ Display of computed flight commands affords quicker, more accurate manual flight operation, or serves as performance monitor for automatic flight system √ "No-vacuum-tube" system employing latest type silicon transistors and magnetic amplifiers √ Suited to installation on inclined panels √ Integrally lighted for optimum dawn-to-dusk readability. For further information, write ECLIPSE-PIONEER DIVISION, BENDIX AVIATION CORPORATION, TETERBORO, NEW JERSEY.

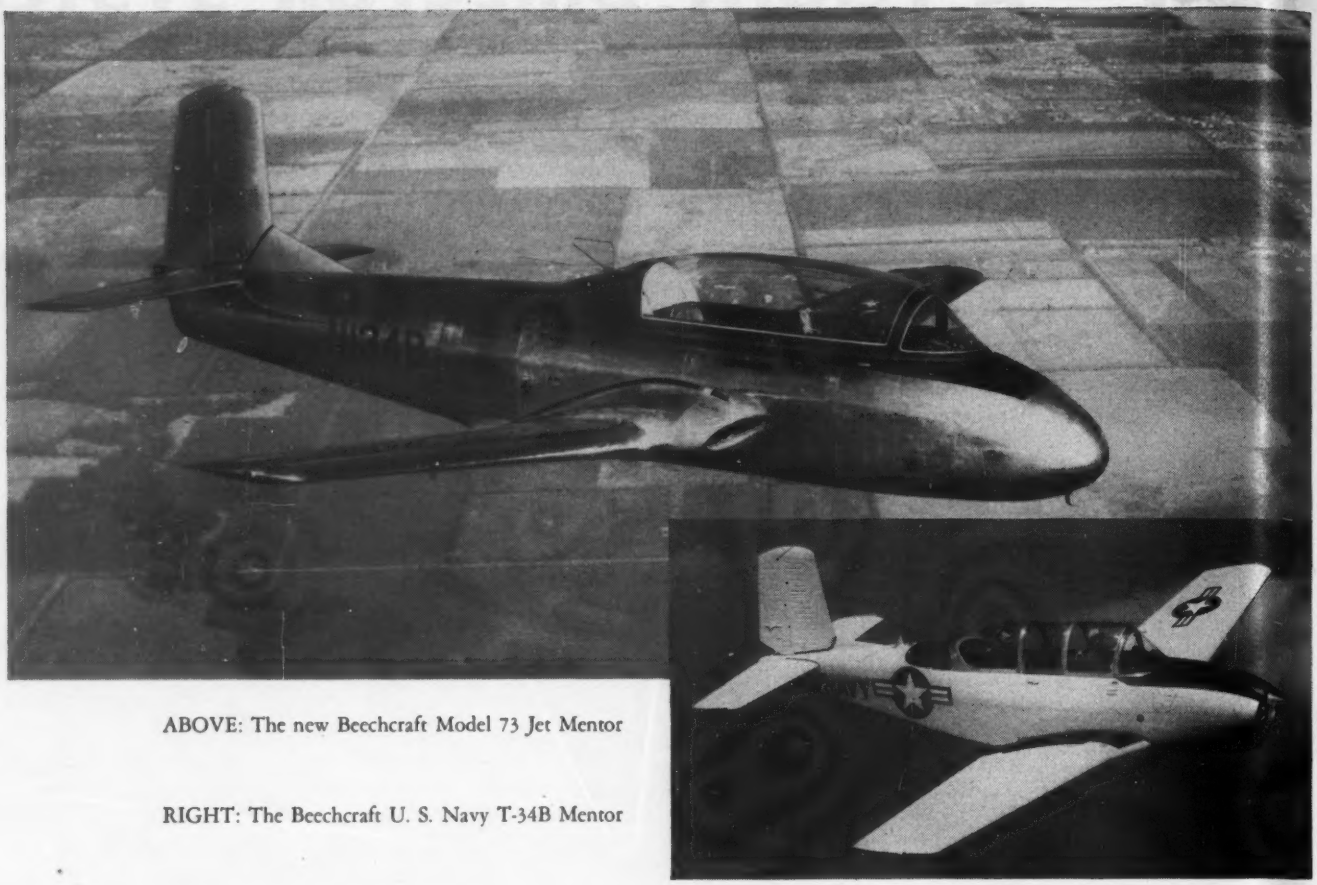
West Coast Office: 117 E. Providencia Ave., Burbank, Calif.
Export Sales and Service: Bendix International Division, 205 E. 42nd Street, New York 17, N. Y.

Let "by Bendix" be your guide to *BUY BENDIX*

ATTENTION ENGINEERS: Opportunities are now available for men with EE, ME and AE degrees in the design and development of automatic flight systems. Send resume today to Mr. C. S. Cleveland, Coordinator of Technical Placement.

Eclipse-Pioneer DIVISION

Bendix AVIATION CORPORATION



ABOVE: The new Beechcraft Model 73 Jet Mentor

RIGHT: The Beechcraft U. S. Navy T-34B Mentor

Sisters Under the Skin

THE NEW BEECHCRAFT Model 73 Jet Mentor is based on the tried and proven Beechcraft T-34, now serving the U. S. Air Force, U. S. Navy and five foreign nations. Both planes use many of the same component parts, and *feature* maximum performance, ease of operation and maintenance and outstanding economy. Both have been developed by Beech Aircraft as private ventures ready for military service throughout the world as "off-the-shelf" trainers.

Students could easily start right off in the Jet Mentor without previous flight instruction. On the other hand, the T-34 and Model 73 are so similar that very little transition would be required to convert from one plane to the other.

The new Beechcraft Jet Mentor represents a significant step forward in jet design simplicity. *It is heavy enough to take it, light enough to be the world's most economical jet trainer.*

PERFORMANCE AND SPECIFICATION DATA

(Engine: Continental J69-T-9 Turbojet)

Cruising Speed	245 mph
High Speed (at 15,000 feet)	295 mph
Diving Speed	500 mph
Service Ceiling	28,000 feet
Range (maximum with reserve)	450 miles
Gross Weight	4,521 pounds
Empty Weight	2,925 pounds
Useful Load	1,596 pounds
Load Factor (ultimate)	11.25 G's
Rate of Climb	1,400 fpm

Beechcraft

Beech Aircraft Corporation, Wichita, Kansas, U.S.A.

BEECH BUILDS: T-34 Trainers for the USAF and USN; L-23 Transports for the U. S. Army; Jet Mentor; MD-3 Mobile Generators; Super 18 Executive Transport; Model D50 Twin-Bonanza; Model G35 Bonanza.

sionary fences which divert the sounds upward, and we can do all sorts of things which will get the noise away from the adjacent community. We think there is a lot of work in research and development for the people who have to work around these planes. You have to have a helmet, wear ear plugs or you will become deaf. We can do things with the new aircraft that we could not do before.

In the F-102, for example, it is possible to climb at a steep angle after take-off, but the noise level goes up so we do not make much money on this maneuver, but we are trying it. The F-102 has a noise level at an altitude of 8,000 or 10,000, that will wake up children on the ground underneath.

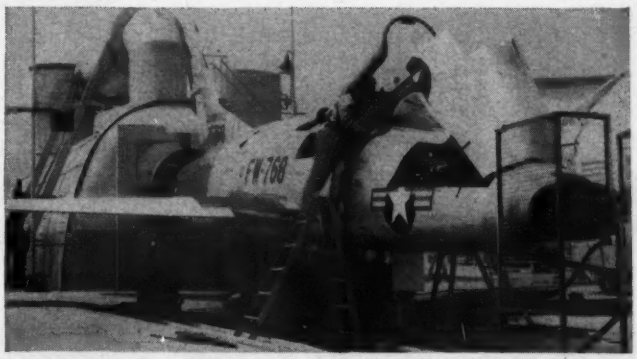
Here are the three things that the Air Force is doing: Public education, research and development, and movement of bases.

Thus far, I have been talking solely about the air base problem. We want better fields, and we would like them in a remote area if it is possible to get them.

The other subject I want to mention very briefly is the matter of air traffic control. Once an airplane gets off the ground, it is a projectile. An airplane going at Mach .9—and that is the general area where most of the airplanes are cruising these days—they are going to cruise higher than this—at .9, they are faster than a pistol bullet, yet we are asking the man who rides on this projectile to use voice radio which has certain limitations, interference, and so forth, to tell the people where he is. Our air traffic is based on reports by the man riding in the projectile and using a voice radio. We think that is impossible, and we think it has to be corrected as rapidly as possible.

You may think that I am criticizing the CAA; nothing could be further from the truth. The CAA is doing a wonderful job so far as we are concerned. I could not do my business in the Air Defense Command without the complete and wholehearted cooperation of the CAA. All of the basic information that goes into the air defense problem of traffic control comes from the CAA. I am not criticizing the CAA. I am just saying that we have to do better. We have to have a new air traffic control facility. The system, whatever it is, must take the airplane as soon as it leaves the ground. it must take it to altitude and take it to its destination, put it back down on the ground and put it in the traffic pattern with a minimum of moves and delay. It must be perfect every time. We do not think you can do this on voice radio. The aircraft are at high speed. If a jet airplane is going from here to there, even though the distance is short, he goes up and back down.

The system must provide the pilot a statement as to his position somehow or other. A pilot just cannot determine it any more. He is going, say, ten miles a minute. Suppose he is over Washington at 40,000 feet. When he looks over the side, he says that he is over Baltimore. He looks out the other side and he says that he is over Quantico,



North American F-100 Super Sabre hooked to a noise suppressor. The AF is trying various methods to cut noise.

because it looks that way underneath him, so his position as reported by him is inadequate at best, and he cannot get the word through to the CAA anyhow.

There is one thing about jet operations that everybody must understand—the pilot is fighting the fuel problem from the time he thinks about the flight. He must do flight planning from the time he starts thinking about going up and he fights that fuel problem until he gets back on the ground again. Fuel consumption is terrific, and if you make a mistake in your let-down, you may find yourself at the wrong airfield and no fuel to climb back up to go to the proper one. You cannot make any mistakes on this decision to let down.

The last thing, regardless of the fact that we are still in the Jet Age, is this: We still have to take care of the people who fly conventional aircraft. So, the system must handle mixed traffic.

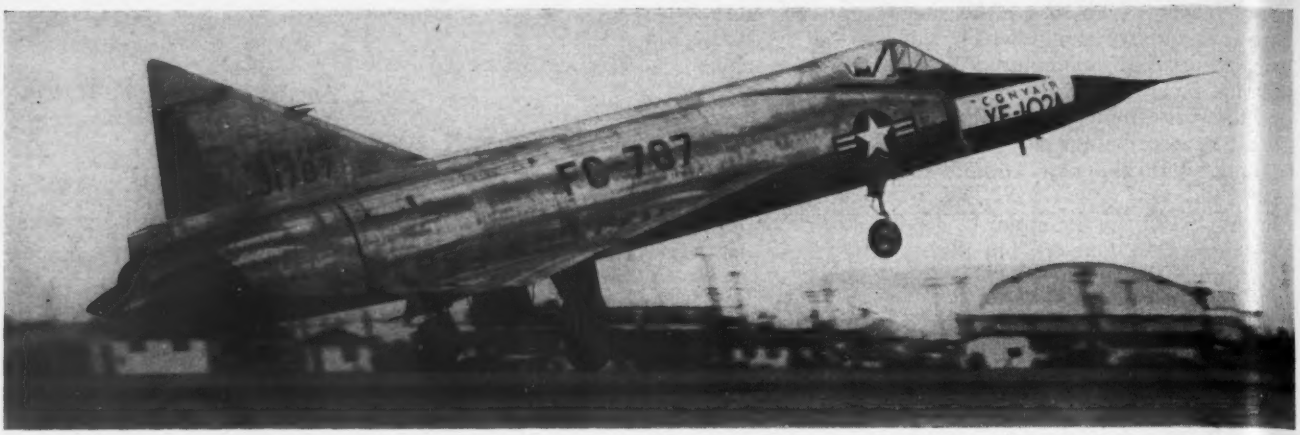
So, there are problems. We want a place to fly from and we want somebody to help us get to our destination—air traffic control. Up to now, this has been a military problem, but it is going to be a civil problem directly. Just how quickly it is going to be a civil problem, I do not know, but it is going to be a civil problem as well as a military problem as soon as you get your first jet transport. . . .

We have some firm requirements and we do not see how to meet them. I have been intentionally on the pessimistic side—not too pessimistic—but I do not want to give you an optimistic picture of our problems at all. We are not solving them, and we need some help.

I might say one more thing: We are not out there demonstrating our prowess by skipping through the doodle, as we used to say. What we are doing now is flying as conservatively as it is possible for us to fly and accomplish the mission. The Air Force has done a wonderful job in reducing its accident rate. In 1921, it was 461 accidents for 600 flying hours; last year, it was twenty, and it has been

(Continued on following page)

All Continental Air Defense Command planes are loaded when on missions. Northrop F-89D Scorpion carries 104 rockets.



As hazards decrease, noise goes up and up. Convair's YF-102A, earlier version of the F-102, makes a noisy take-off.

going down steadily in the post-war years. We are very proud of this, but we cannot get around the fact that we are causing a lot of commotion; there is a lot of nuisance and hazard involved. Somehow or other, we are going to have to educate the public to the fact that they must accept this annoyance in the interest of national defense.

• • •

Jean DuBuque [National Business Aircraft Association]: When military jet aircraft move in on civil airports on a joint use basis, on many occasions the civil aircraft operators are either forced off the base or are so restricted in their operation that civil aviation in that community dies on the vine. Many city fathers have complained, in connection with problems of joint use, that they do not understand Air Force Regulation 87-7, which is so complex in many of its provisions that it is difficult for them to work with it. What is being done in that connection?

General Partridge: I join the city fathers. I do not understand it either. [Laughter] I am sorry to say that I am not familiar with this particular regulation. I probably know the contents, but not by that number.

Mr. DuBuque: It is a joint use agreement.

General Partridge: The decision to move into the civil airports was taken during the Korean war when it became apparent that we did not have an air defense system. We just had to barge in and get under way. We would like to move off the civil airports, but we do not have the money to do it. In the meanwhile, the base commanders should get together with everybody who operates on that base and, on a day-to-day basis, discuss every single aspect of the operations. If they are not doing that, we can see that they do do it. It is inevitable that if you put more airplanes on the field than the field will accommodate, then somebody has to give, and, up to now, in the urgency of the defense problem, it is the civil aviator who has had to give many times. I regret this, but I cannot fix it. The only way to solve the problem is to discuss it at the field level in detail and try to work out agreements by which we can live together until we get separated.

Harold C. Stuart: I notice in all of this discussion of moving to other locations, nothing is said about the required housing, the recreational facilities, and the things for the comfort of the airmen and the pilots. We spend millions and millions of dollars training these people. They are entitled to some life with their families, and when you move to an isolated area, you have no schools, no churches, no recreational facilities and no houses, so you cannot get the boys to go in. Is that not correct?

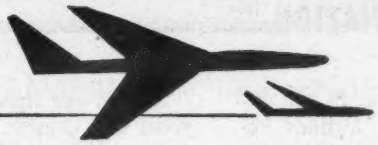
General Partridge: This is a very difficult problem for us to solve under our system of government. I do not believe many people appreciate the difficulty of getting a military construction program to agree with the government. There are lots of folks around with red pencils. If you put in a complete base, a package such as we need when we go to a remote area, there are a lot of sharpshooters who go through the items one by one, and they take out the family housing, and take out the gymnasium, the chapel, and the swimming pool, and they say that we can operate a base without all of these things. We say, "Sure we can, but at the end of four years, the men will get out, and we have lost $15,000 apiece, or something like that, which we have invested in them. They would stay with us if they had some place to have some fun or to live a normal life."

It is a sad story. The fact is, under the current arrangements in government, it is absolutely impossible to get a packaged air base which will come complete with all of those facilities. Something has to be done about it.

Crocker Snow [National Association of State Aviation Officials]: With respect to the eighteen joint use bases, I think it is safe to say that when your jet fighters are operating in VFR weather, they make what is called a tactical approach, an overhead break, and all of the other airplanes, including the airlines and everybody else, use what is called the conventional approach in landing. Is it necessary to the performance of your mission that fighters make that type of approach to landing?

General Partridge: The answer to that is no, in my opinion, and I am going to break the hearts of all of the fighter people in the United States when I say that. This maneuver was developed initially to assist in the spacing of the formation of aircraft. We would bring four or eight fighters in, and you had to have some way of getting separated in the radio pattern, and if the radio is out—radios were not always as reliable as they are now—the pilot had to know ahead of time what runway he was going to use. We developed this wonderful custom of just coming by and peeling off in so many seconds—six, eight, and so on—and forming the traffic pattern. It is a lot of fun and you cannot make the mistake that General Doolittle and I once did. We were in the back-end of an F-94 up in Goose Bay. The pilot got both hands on the stick and then hauled back on it. The G force is something like eight Gs—more than it should be—and the passenger in the back seat loses oxygen [Laughter]. General Doolittle probably knows what I am talking about. This was seven o'clock in the morning. I do not think this maneuver is necessary. They call me "Square-Pattern" Partridge. [Laughter]—END

the jet age



Commercial Aviation's Future

Milton W. Arnold
VICE PRESIDENT, OPERATIONS, AIR TRANSPORT ASSOCIATION

THE SCHEDULED airlines are setting the stage for their appearance in the Jet Age of the future. Approximately $1 billion for jet transports has been committed, and some say $2 billion will be spent in major fleet conversions to turboprop and turbojet before airline demands are met.

This is a bold step. The way ahead will be fraught with problems—which will be licked, granted sufficient patience and perseverance. Let's look back for a minute to see where we have been, before taking a look ahead.

In the past five years, the scheduled airlines, which the Air Transport Association represents, have doubled the number of people carried. Last year that meant that 38,550,000 passengers flew on the scheduled airlines in the United States. Our fleet may seem small in numbers—1,162 aircraft—when compared to approximately 25,000 military aircraft based in the United States. Nevertheless, our utilization in hours runs high. The scheduled airlines account for *more than half* of all the instrument hours flown in the country.

To give you an example, let me cite one regional carrier. It moves 5,000 seats into the state of Florida every twenty-four hours. Further, every eleven minutes out of the day one of its aircraft crosses the Florida state line, either coming or going. This is only part of the service provided to Florida, but it gives you an idea of the type of service asked for by the public and provided by the airlines.

The aircraft of the scheduled airlines have two things in common with the private pilot, business aircraft, and our military air arms. One is joint use of the airspace, and the other is joint use of airports—to a degree.

Of course, there are many airports which are strictly military air bases, from which—and rightfully so—civilian aircraft are excluded. But the record shows, so far as the airlines are concerned, that nearly equal rights to use military bases have been afforded the airlines when compared to rights granted the military to use civil airports. A recent count showed that the scheduled carriers used sixty-two strictly military air bases as scheduled stops. There are 102 civil airports served by the airlines at which a military activity is based.

This latter situation has occurred as a result of the rapid build-up of our air arm during and after the Korean war. Duplication of facilities, when not utilized to their full extent, will constitute a needless waste of our national treasure.

How have we fared in this joint use of airports? Well, we can say that we are serving sixty-two points which wouldn't have air service unless another airport were built. This means better service to those communities, many of which could not provide an airport under any circumstances.

At those civil airports where the military have placed an activity, such as Air Defense Command, National Guard, Air Reserve, Tactical, Strategic, or Troop units, the record by and large is plus.

In one large city the airlines needed a longer runway. The land needed was held by a powerful group opposed to any improvement to the airport. I cannot identify this group, but their favorite means of locomotion was not by air. Into this picture stepped the Air National Guard. It had a unit based on this field and transition to jets was programmed. They carried the ball on condemnation proceedings, got the land and the much-needed runway extension.

We haven't always been so lucky. Sometimes we have been downright in the middle, through no fault of our own. At another large city where joint use would have been beneficial to us, our people individually and unknowingly turned down the establishment of a unit on that field. Local pressure had been applied and succeeded. Our combined embarrassment over this incident has never subsided.

MILTON W. ARNOLD, *a retired Air Force brigadier general, was born in Hogansville, Ga., and attended the Georgia School of Technology. He was graduated from the US Military Academy in 1931 and received a master's degree from the California Institute of Technology. An active pilot since 1931, he pioneered the North Atlantic route for the Air Transport Command in World War II and was later Chief of Operations of the Second Air Division, Eighth Air Force. He retired in 1946 and became vice president, Operations and Engineering, Air Transport Association.*

Coins have two sides. There are some places where "never the twain should meet." Our Navy friends think this about Boca Chica down at Key West, Fla. We have earmarked a few places like the New York airports, Chicago-Midway and Miami International, where addition of military units would be a catastrophe. Pittsburgh was on our list, but—with recent services added to Pittsburgh—the shoe will soon pinch there. Mistakes are allowed on both sides. We recognize the need for some exclusive-use military bases, just as the military recognizes that some high-density civil airports should be left to the civilian activity. On or off the record, we are getting along pretty well in this area.

In our other common medium, the airspace, problems

(Continued on following page)

which are complex now may well be more so in the future. The present-day airspace used by the airlines extends up to 25,000 feet. Above that will be the new ocean for air commerce, with the introduction of jets. The military are already there. They too must share our concern about meeting the common navigation problems which will develop. We are working together with them so that time won't run out when the jet enters air commerce.

Most of our experience in joint use of the airspace has been below 25,000 feet. As you know, the great utility of the airplane is its ability to fly in a straight line between two points. It can still do that, but many obstacles today arise to prevent it.

All forms of air transport have had phenomenal growth in the past few years. Business flying now exceeds in total hours the numbers of hours flown by the airlines. Private flying is increasing. The Air Force has almost reached its goal of 137 wings. But the problem of getting from "A" to "B" is rougher than getting the butter in a boarding house.

As Durante says, "Everyone wants to get into the act." Television towers ram up from the bottom. Demolition dumps get a "Restricted" area. Atomic Energy gets a "Prohibited Area." Anti-aircraft gets a "Controlled Firing" area. Surface Navy and Air Navy, along with Air Force, have acquired "Warning" areas from our coastline to hundreds of miles at sea. Don't leave out guided missiles or huge areas set aside for aircraft testing, bombing ranges, and gunnery ranges. Essential? Many of them, probably. Duplication? A good bit.

Even those blank spaces between the airways, known as "off-airways," are disappearing because training and acrobatics, simulated missions and refuelings go on there to a degree never before contemplated.

There is just so much airspace, and no more. It should be looked upon as a natural resource like gas, water, or petroleum. Poor planning or extravagance in its use can destroy its utility and lose a battle for us every day. Circuitous routings waste fuel, airframe and engine time, man hours on the ground and in the air of the business community, and of flight and ground personnel. Technicians or generals who are in the air an extra thirty minutes are out of the battle for the same amount of time. Our business is to keep them in the battle with the shortest possible flight time.

How are we dividing this resource among our services and the civil users? Do we have a plan? No, we don't. It's first come, first served. With airways detouring between the blocks of reserved airspace, the longest way around is the shortest way home.

In one block of air between Washington and Springfield, Mass., comprising 25,250 square miles, only 1,300 square miles are not restricted or controlled. This story is slowly being duplicated throughout the land. For the first time, the CAA has come forward with a five-year plan encompassing future air traffic control requirements. Such a step should be taken in connection with the use of all our airspace. This look ahead was asked for by the President's Air Coordinating Committee in April of 1955. We haven't the answer yet, but we are hopeful that a more realistic sharing of airspace will result.

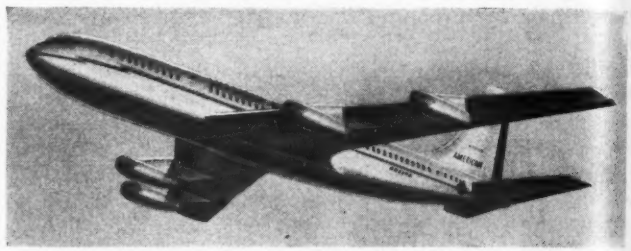
Will our jets escape airspace problems? We don't think so. Even today many of our restricted areas extend from the surface to "unlimited"—or infinity, if you will. These must be circumvented. As we penetrate more and more into the atmosphere and beyond, there will be need for such areas or perhaps control over these new activities in conjunction with other traffic.

So far, our sights are down. We need to raise them beyond our present day-to-day methods so that each user can get the most out of the machines we create. Our national defense must be strong. Our national air transportation must be fast. In solving the one, we should solve the other.

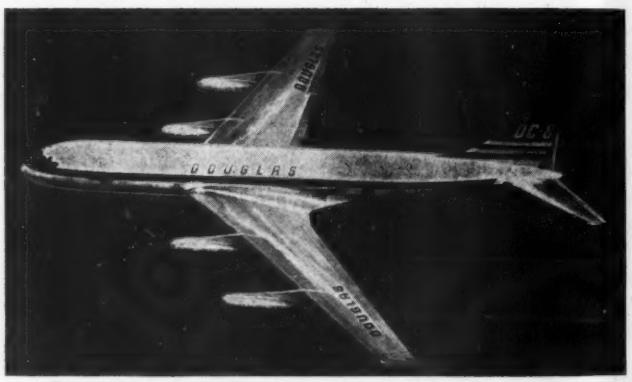
It is easy to stand by and complain and let the other fellow work it out. We do a little prodding, occasionally. We also work hard with the Air Force when permitted to do so. We think that there are areas where such cooperation would be beneficial to us and to them.

In airport planning we know the chief concern is the real estate. But the cheapest piece of land on the Washington-New York route isn't worth the delays which will, like Mary's lamb, be sure to follow. We think that the trend to get the land and fit the operation in should be reversed.

There are times when it is easier for the Air Force to "skin the cat." The runway extension mentioned earlier



"Approximately one billion dollars for jet transports has been committed." Above—Boeing's intercontinental jet.



"The scheduled airlines are setting the stage for their appearance in the Jet Age." Above—Douglas DC-8 transport.

is a good example. There are times when we, Civil Air Transport, carry the ball and willingly. The National Air Coordinating Committee, which handles the noise problem in New York, is a good example. We can and should complement each other more in those areas where one interest or the other predominates.

We aren't discouraged about the coming of jets. We have almost three years before their introduction commercially. This time can be well spent by all of us in putting our house in order.

We are ready to do even more than we have been able to in the past to assist in better airport planning, programming and community relations.

But, regarding the most serious situation—

I submit that the problem of our vanishing airspace is so serious that the public, the Congress, and the executive branch of the government have not fully begun to appreciate it. I submit that it is so serious that even many of the aviation experts in this room have not understood

the full threat it represents. How serious is it? The clue is to be found in the evaluation made by the Harding Committee—the Aviation Facilities Study Group, which recently completed its report to the Budget Bureau [see AIR FORCE Magazine, February '56, page 60]. It is so serious that the failure to start now to build a solution will mean the throttling or the breakdown of American airpower in the future. That's how serious the problem is.

Is there nothing we can do about the problem? Of course there is something we can do about it. Again, the path is pointed by the non-partisan study made by the Harding Committee. What we need to do is a typically American thing—we need to set out and invent a completely new, a completely revolutionary method for controlling air traffic. We know in general what is needed. And, I submit, we can invent a system to satisfy those needs. No such system exists in the world today. Well, let's show the rest of the world the way.

How do we start building the bold new system we must have? It would seem to me that the first step is for the President to take the initial step recommended by the Harding report—to appoint a figure of national prominence and acknowledged competence to serve as the personal representative of the President in developing a program for providing an air traffic control program adequate to the nation's needs. This representative must have the authority to compel the cooperation of both civil and military aviation authorities. And he must remember that the solution to this national problem must have the support of leaders of both parties. *[This appointment has been made—AFA's own Ted Curtis, of Eastman Kodak and our Board of Directors.—The Editors.]*

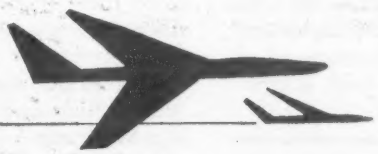
Let us remember that the air is a precious asset to be used for the benefit of all the American people. It is not a commodity to be bartered away for the advantage of any one group. But the American people are not going to be able to use the American air unless steps are taken promptly—that means they should start today—to provide a system of air traffic control adequate to the nation's future needs.

• • •

Jean DuBuque [National Business Aircraft Association]: When you propose that a new system of air traffic control be established in the future, does that means that VOR/DME or TACAN will be obsolete? What type of system is it that you propose—a short system or a long-range system?

General Arnold: I do not think that TACAN or VOR/DME are systems of traffic control. They are gadgets. I think we need a complete engineering system evaluation of the handling of traffic. The devices which you speak of, in my estimation, are navigation aids. I think that unfortunately all of us—and I include myself—tend to think of these gadgets as having souls, and we take great pride in defending them. I think they have no feeling. They are pieces of gear to be used to improvise a system of traffic control.—END

the jet age



AF Reserve—Problems and Requirements

Maj. Gen. William E. Hall
ASSISTANT CHIEF OF STAFF, RESERVE FORCES, USAF

I THINK if I were to make a list of the top ten items which most profoundly affect the future of the Air Reserve forces, I would certainly include in that list base congestion, air lane congestion, runway extension, jet noise and certainly the most important, public reaction to all of these factors. The three primary elements of any program, be it military, commercial, Regular or Reserve, are personnel, equipment, and facilities.

With respect to the first two elements, personnel and equipment, we feel that the Air Reserve has made and can continue to make very gratifying progress, but our aim is a combat-ready Reserve, and people and airplanes alone do not provide a combat force. We must have facilities from which to train, and we must have facilities from which to operate should that need arise. This is the weak link in our chain, and with increasing jet operations, I'm afraid it will get a lot weaker before it gets stronger unless we find the key to public understanding and acceptance of these facts.

(Continued on following page)

I am sure I do not need to tell this gathering that Reserve facilities requirements differ to a degree from those of the active establishment. An active bomber base, for example, can be located at a considerable distance from any sizable city. This may not be the most desirable solution but, nonetheless, it can be done.

A Reserve unit, on the other hand, has no alternative. It must be accessible to the people who man the unit.

Just recently, we completed a study of the Air Force use problem faced by the Air Force Reserve. The results, though not a bit startling, are quite convincing. In general, some communities have given the Air Force Reserve a very heart-warming welcome. On the other hand, a disturbing number of others have opposed and will oppose us to the last ditch. I will try to present both sides of this coin.

Since 1951, we have had fourteen gravely serious problem areas in major cities due to official and/or public opposition. Each of these sites had already been selected by the Air Force for its excellent Reserve population potential. Some had been selected in accordance with air defense requirements. All had been selected because the Air Force not only wanted but felt that it needed to establish Reserve flying units at these locations. In six of them, Reserve units were already operating. Yet, in three of these fourteen sites, the outcome is still unresolved and unpredictable. The problem in the remaining eleven has been resolved, but more than fifty percent of these resolutions is most disappointing. Six of these eleven cities have denied the Air Force Reserve use of their local airports. The result is that we are now engaged in a long and drawn out, expensive procedure of finding new sites in these general areas in which we have a requirement.

MAJ. GEN. WILLIAM E. HALL *has been USAF Assistant Chief of Staff for Reserve Forces since 1953. He was born at McAlester, Okla., October 22, 1907, was graduated from the US Military Academy in June 1929, and completed advanced flying training at Kelly Field, Tex., in June 1934. During World War II he served at AF Headquarters and also in the Mediterranean and Italy. In September 1948 he went to European Command Headquarters as Director of Intelligence and later assumed command of the Fourth AF in California. He is rated as both a command pilot and observer.*

When you consider the tremendous number of Reservists in such places as Cleveland, for example, and Tampa, which are two of the six areas I mentioned, you can begin to realize the extent of damage that can accrue to the program.

In summary, then, in all of the fourteen problem areas we have been able so far to locate on a firm basis in only five, and that is since 1951. Even in these five, success has been achieved by some very narrow margins; and even in these five, successful negotiations have been extremely time-consuming with resultant delays in combat readiness of Reserve units. In one location, talks and negotiations consumed more than three and a half years.

When we examine the avowed reasons for public opposition in these fourteen problem areas, we find the following: noise nuisance; jet aircraft a hazard to civilian carriers; jet aircraft decrease value of neighboring properties; space and facilities needed by Air Force Reserve involves loss of taxable property to state and municipality; fear the Air Force intends to take over entire airport; heavy commercial operations need further development; jet aircraft greatly increase danger of accidents; and heavy congestion already exists in area, especially in bad weather.

Whether or not we in the Air Force consider these as valid reasons is, in my opinion, not of too much importance right now. The fact is that a large segment of the American population does consider these reasons valid. Then our job is to convince this segment of the population that some other things are valid also, maybe even overriding. I refer to protection of homes, industries, and the nation. That is all on the black side of the coin. There is definitely a brighter side.

In the first place, to correct some of these deficiencies, the Air Force today is being extremely select in its choice of sites for Reserve flying units. We are giving as much thought as possible to public receptions with respect to the Reserve manning potential in a particular area. In addition to that, we have gone to the detached squadron plan. This plan, although requiring many more actual sites in number, does permit the use of airports in smaller communities and thereby reduces overcrowding and traffic congestion.

Operationally, which is the principal reason for the detached squadron plan, this holds tremendous promise. Just recently, I received a letter from General Partridge, the Commander-in-Chief of the Continental Air Defense Command, in which he said in part, "From the Air Defense standpoint, the detached squadron plan proposed by the Continental Air Command is much more desirable than the present concentration of Reserve fighter-bomber squadrons in large population areas. We believe that when these Reserve fighter-bomber units become separate squadrons operating independently, they will add considerably to our air defense capability."

This brings me to what I refer to as the Muskogee story. Muskogee, Okla., has a population of 37,000. It is in the eastern part of Oklahoma, fifty-nine miles southeast of Tulsa. Its main industries are oil supplies, manufacturing, and I think certainly enterprise. The city-owned Davis Field, which had been an Army Air Base in World War II, was later returned to Muskogee. Muskogee's mayor and city councilmen are progressive, wide-awake and patriotic. They decided to do something about Davis Field and, to that end, visited Headquarters, Fourteenth Air Force, to submit a proposal. There were naturally certain needful negotiations. It was decided that Muskogee would have to make repairs to the runway, aprons, electrical and water installations, and secure additional labor. All this was undertaken by the city with the enthusiastic support of the mayor and councilmen, the newspaper, businessmen and plain John Q.

On last November 8, the 713th Fighter-Bomber Squadron was activated at Davis Field.

At Christmas, I received a telegram from Muskogee's able mayor, Lyman Beard. I would like to read it.

"Our self-imposed goal of 100 officers and airmen in the 713th by January first has already been accomplished. We have 104 men either in the squadron or with applications pending as of today and I feel even more confident in the future. We may be applying for a second Reserve squadron. Best wishes for a Merry Christmas and a Happy New Year, and be sure we are keeping faith with you.

Lyman."

We have our troubles. I have tried to pinpoint some of them for you this morning. We are going to have a lot more, but I think we also have our Muskogees.—END

the jet age

The Air Guard and the Community

Maj. Gen. Winston P. Wilson
CHIEF, AF DIVISION, NATIONAL GUARD BUREAU

THE AIR National Guard is today the biggest military user of civilian airfields. I make this remark because I believe it is typical of Air Guard operations. Our units, situated throughout the forty-eight states and territories, occupy facilities in 155 different locations. Approximately seventy of these are civilian airfields housing flying and non-flying units of the Air National Guard. This compares, according to our facilities charts, to forty-one civilian fields having some form of Air Force activities, twenty-four Navy, five Army, and three Coast Guard.

By way of background to the selection of these civilian fields for Air National Guard activities, at the end of World War II there were only twenty-nine air units in the National Guard. These twenty-nine units—all observation squadrons and then part of the Army National Guard—were the forerunners of the Air National Guard as we know it today. Following World War II, Air Guard planners anxious to get their program under way came to the conclusion that our units should be located, where possible, on an in-being facility and in an area where the manpower pool would permit extensive recruiting and rapid build-up of the Air National Guard organization. It was simply a matter of bringing these two together. The civilian airfields, many of them built or expanded during World War II by the Air Force, and then turned over to the municipalities, were "naturals" in this planning.

The National Guard Bureau, in conjunction with the Air Force, determined requirements, established airfield criteria, and then went to work assisting the states in organizing units, generally on a per capita basis. The Adjutants General of the respective states and territories were given the responsibility for negotiating leases and service contracts, both subject to approval by the National Guard Bureau. Municipal authorities and airport managers were contacted and negotiations started. The relationship established at that time between the states and the airport managers has for the most part continued amicably, and the Air Guard units have since been a welcome addition to the community life of the cities where they are located.

This is the manner in which the Adjutant General obtains occupancy of a civilian field. The first step is to obtain the approval of the municipal authorities and the airport managers. A long-term lease must be obtained where any federal construction is contemplated. Present requirements call for a fifty-year lease unless unusual circumstances warrant a waiver, such as in the case where a Virginia state statute prohibited the city of Richmond from entering into a lease in excess of thirty years.

Once the lease is obtained, a service contract must be negotiated. Under this contract the airport authority agrees to Air National Guard use of the runways and agrees to provide such services as snow removal, weed cutting, structural fire protection, and control tower support in return for a fixed fee. This contract is renegotiated annually to conform to government funding procedures, and the federal government bears seventy-five percent of the cost and the state twenty-five percent. There is no solid pattern covering these contracts, and they vary from field to field depending upon the services that are provided.

Generally speaking, our leases have been readily negotiated and the annual renegotiation of the service contracts have been accomplished without the encountering of any real problems. This does not mean, however, that the Air National Guard has not run into any difficulties or problems relative to the use of civilian fields. Before going into these problems and the action taken by the Air National Guard to overcome them, I want to briefly discuss the advantages of present Air National Guard locations.

We are all aware that any air attack against this country will see the weight of that attack directed against our communications and industrial centers. It naturally follows that our air defense effort must be aimed at the protection of these centers to insure that they will not be knocked out or seriously crippled. The deployment of Air National Guard units, as part of the defense effort, fits neatly into this picture. Our flying units are located in or near our major cities and in a position to join readily in their defense.

But aside from this strategic advantage, there are other advantages which work to the benefit of both the Air National Guard and the cities concerned. From the standpoint of the Air National Guard the two chief assets are the existence of an in-being field and abundance of manpower. Available construction dollars stretch much farther when they are used to improve already existing facilities than they would if we were to undertake construction of complete facilities. The cost of such a program would, as

(Continued on following page)

you know, be prohibitive. As for manpower, our operation is of such nature that it requires a wealth of the technical skills which are available only in the diversified industrial set-up of the city.

We need mechanics in great numbers, communications and electronics experts, shop men, professional men, and men skilled in administration. In addition, however, to their availability in numbers, our personnel must be in a position to mobilize readily. The extensive communications network and transportation facilities available in the city are likewise assets to any mobilization. Our Air Guardsmen can be alerted quickly and almost simultaneously, and they can get to the airfield in short order and in large numbers.

This is of particular importance to a reserve component where time would be of the essence if a threat of attack should arise. Aircraft waiting on the field ready for interception are of no good to us unless we can get the pilots into the cockpits and the aircraft into the air with a minimum of delay. We have been able to do just that. The ability of the Air National Guard to beat the time periods set for mobilization added to the success of our recruiting efforts is proof in itself that the cities with their readily available airfields are the best spots for the deployment of reserve units.

MAJ. GEN. WINSTON P. WILSON, *Chief, AF Division, National Guard Bureau, was born in 1911 in Arkansas and was graduated from Hendrix College. He was commissioned in the Arkansas National Guard in 1940 and, after serving with several groups, became Chief of the Tactical Reconnaissance Branch at Army Air Corps Hq., Washington, D. C., in 1943. He commanded the 16th Photographic Squadron and served as liaison officer in the Pacific in 1945. The Air Force recalled Gen. Wilson to active duty in 1950. He became Deputy Chief of the Guard Bureau in 1955.*

From the municipal point of view, the Air National Guard offers improved facilities, additional income, and training programs which increase the skill levels of its manpower. We have improved and extended runways, built aircraft parking aprons and taxiways, provided crash and fire protection facilities, and accomplished other improvements too numerous to mention. Our investment in these facilities has been sizable since 1951—$93.5 million having been obligated over the period from 1946 through June 1955. This year we expect to obligate another $14 million on these fields. This gives you some idea of the investment that the Air National Guard has in these civilian fields; it represents a substantial capital improvement.

But aside from construction dollars, the Air National Guard is a source of other community income, which likewise contributes to the maintenance of a stable economy within the communities. The federal funds appropriated for the support of the Air National Guard are intended to provide a first line and ready reserve. Certain of these funds are allotted to each state annually, and a substantial amount is funneled directly into the communities where our units are located. As an example, one state, typical of those states having only a tactical squadron, obligated almost $700,000 in federal funds during Fiscal Year 1955. Of this amount, $600,000 covered military and air technician pay, and the balance covered such things as local purchases, service contracts, and miscellaneous operating expense. These dollars increased purchasing power and worked to the benefit of the community as a whole.

As to our training program let me say that more than 22,000 Air Guardmen have completed service schools and technical training under Air National Guard quotas, the vast majority of them in the last three to four years. Sixty percent of the technical courses offered by the United States Air Force are now participated in by the Air National Guard. The benefit to the local community is reflected in the type of courses offered. These include, aside from flight training and other aviation courses, training of many phases in such fields as communications, construction, vehicle maintenance, medical technician, accounting and auditing, fire fighting, food service, photography, public relations, and many others. It is easy to see from the extent that Air Guardsmen have participated in these courses and from the nature of the courses themselves that the Air National Guard training program adds considerably to the skill levels of the surrounding community.

I have given you here just a few of the advantages, as I see them, that surround Air National Guard use of our civilian fields. The chief disadvantage has been the objection of certain airport authorities and communities to military aircraft operations. We are well aware of that problem, a problem accentuated by the advent of jet aircraft. The Air National Guard is no stranger to this problem; we have lived with it for some time, as have the other military components, and we are working harder than ever to insure its satisfactory solution. We have run into opposition of varying degree: from airport operators, from civic groups, from the individual. This opposition is generally found in the areas where any kind of military aircraft operations are frowned upon. We recognize the need for mutual understanding and the situation has demanded a major public relations effort on our part.

Fortunately, in only a few instances have we had differences that could not be ironed out. In those cases certain civilian fields, which we felt were ideally fitted to Air National Guard operations and which entered into our planning, had to be dropped from our program due to local opposition, and other locations substituted. These relocations have disrupted our programming and set back our time schedule, and I believe they have worked somewhat to the disadvantage of the particular areas concerned. But even with the completion of these moves and the finalizing of our facilities program the problem will not be completely licked. We still must continue our all-out efforts to win the confidence and support of the airport operators and the civilian populace. They must be convinced that the benefits derived from such an operation far outweigh the disadvantages.

On this score the noise associated with jet aircraft operations has become the subject of complaints by the civilian population adjacent to our airfields. The National Guard Bureau has impressed upon the states, and the states in turn upon the units, the need to alleviate this situation. Our program calls for such things as the establishment of isolated areas for engine run-ups, construction of blast ramps, indoctrination of crew members, installation of jet plane arresting gear where conditions require, and the use of public education programs to inform various communities of the necessity for jet aircraft as part of an adequate national defense.

Along this line, even the traffic patterns of our jet aircraft have been raised to higher altitudes and directed

over unpopulated areas whenever possible. We hope, through this program, to eliminate much of the noise nuisance, and to impress upon the community that we in the Air National Guard are not ignoring the situation, but instead doing all within our power to correct it. I was told that one of our serious problems in St. Paul was solved when the judge ruled with the Commission, which will let us go on with our jet program there.

On the brighter side, I am particularly pleased that I can report that the Air National Guard has made substantial progress in solving a number of installations problems which plagued it for years. In all, twelve of our squadrons had no suitable base from which they could operate jet aircraft. The problems of these squadrons have been solved or are readily near solution, and we have enjoyed the cooperation of local governments, the Air Force, and the Navy. At two civilian fields, runway extensions that had been previously blocked are now in the planning stage, and upon the completion of this construction the units will convert to jet operations. Three new locations, two of them civilian fields and one a private field, have been secured for units which have to move because present facilities cannot accommodate jet aircraft. We are about to complete negotiations for Air Guard use of one naval facility, one Air Force facility, and three civilian fields which take care of five squadrons scheduled to convert to jet operations. Negotiations now under way will solve the problems of our last two squadrons.

Pilots must be able to get into their planes and into the air without delay to perform their missions effectively.

The Air National Guard has been doing its part in enlarging the present system of airports in the United States. The use of jet aircraft dictates a need for durable runways of great length. With few exceptions, the assignment of jet aircraft to an Air Guard unit has necessitated the extension of the runway system. Only those airfields adjacent to the largest cities, and military installations, had runways adequate in length for jet operations, while the great majority of bases selected for Air Guard units had runways approximating 5,000 feet. Expansion of the runway systems at these fields to 7,000 feet to conform to Air National Guard criteria places them in a class with the CAA "Intercontinental" airfield, next to the highest classification within the CAA system.

It is readily apparent that inasmuch as the Air National Guard is generally located on CAA or municipal fields of lesser class, the construction program of the Air National Guard has and will greatly benefit these airports. The improvements we are providing will permit these fields to broaden their commercial operations to a scale not previously possible, and as the airlines bring their more modern transports into these fields, they will find that the ANG has to a considerable extent literally "paved" the way.

• • •

John A. Mack [Vice Commander, New York Wing of AFA]: It is quite evident that the apathy with respect to the Reserve program and the location of bases is caused by a vocal few who are apparently unaware of the requirements of the Reserve program. Is it possible for the Reserve organization to start a personal contact educational program similar to that of ConAC to overcome the public apathy?

General Wilson: Yes, and that would certainly be highly desirable. One of the most active areas under what we like to think of as our vitalized Reserve program which began about two and a half years ago is in the field of public information. I believe we have accomplished a great deal. It was a field which up to that time had been terribly neglected. I am sure that we have only scratched the surface, and anything that organizations which have a Reserve interest can do to acquaint the public with our problem would be of great benefit.

Mr. Mack: General Hall, I think these are doing their darnedest with the local civic groups. I feel all of the publicity in the world that we might get in the press wouldn't do half as much as personal contact. Has any program been established for a speakers group to get out and inform the public of the necessity?

General Hall: Yes, a program is in the process of development right now which should result in tangible results about in April. In addition to that, the Chamber of Commerce has been most active in its assistance to us and has recently been provided with a brochure which explains the problem reasonably well. In addition to that, we are calling upon all Air Force agencies in the field to cooperate in these Chamber of Commerce meetings, and we have provided the prospective individuals who would appear with what we consider problem material. There is no limit to what can be done. You never have the problem whipped. Maybe one personal call is the answer to a particular location.

Douglas C. Wolfe [Commissioner, Department of Aviation, Binghamton, New York]: Several years ago my county requested the Air Force to consider Broome County for an Air Force base for Reserve training. We have been advised that we have sufficient personnel available and that we appear to meet all of the requirements. However, since then we have received no formal recognition. Can you tell us how we can develop further interest on the part of the Air Force to become interested in Broome County?

General Hall: I would be happy to see you after the meeting and provide you with the information that you need. However, it may be of some interest to you to know that there are many, many areas in the United States which are very active in their efforts to secure both Reserve and Guard planning units, and it just happens that there is no actual requirement in that particular locality. Therefore, we have the paradox of being wanted where we do not think we should be in a lot of cases and trying to get where we are not wanted in a lot of other cases.—END

the jet age

What's Ahead for Business Aviation?

Henry W. Boggess
PRESIDENT, NATIONAL BUSINESS AIRCRAFT ASSOCIATION

IN ALL our efforts to evaluate the on-coming Air Age, and to so plan that its toughest problems may be foreseen and minimized, if not circumvented, we should mark well the sage advice of the President of the Air Force Association. Gill Robb Wilson has often said that men everywhere, in every age and in every culture, have never yet dared to dream big enough, to think big enough, and to plan big enough.

Our beloved country suffers today in many ways for our failure to dream big enough, think big enough, and plan big enough. In our own generation, we have witnessed our own inability to foresee and evaluate the full import of the automobile. That failure has resulted in the literal waste of thousands of millions of dollars in traffic jams, in tearing up and rebuilding, and in needless carnage on almost every street and highway throughout the length and breadth of our land.

The social and the economic effects of the automobile were not foreseen and were not adequately planned for. Had they been, evolutionary adjustments could and would have been made more readily, more logically, and much more economically.

Realizing man's timidity in predicting the future, recognizing his reluctance to stick out his neck, as well as his historical prophetic weaknesses, I am thankful for this occasion. I personally feel that the Air Force Association is to be highly commended for providing leadership for all branches and segments of aviation in trying to ferret out and foresee the problems of the on-coming Air Age. I am hopeful that its efforts will result in a solid front of all aviation interests that will succeed in finding appropriate ways and means of minimizing and preventing what might otherwise well be costly mistakes.

It is a fact that the Air Age is rushing toward us. We are woefully late in preparing for it. We are actually facing a very rough situation which will command all of our brains and all of our energies to cope with and to handle it.

Admitting this fact should not frighten us or panic us. Whatever changes the Air Age may bring, however complicated the problems that rush at us, we must have faith that man is both adaptable and ingenious. Once faced with a recognized necessity, man's talents can solve the greatest secrets of the universe—as we have witnessed in nuclear fission. Believing this, we only need to join hands—military, transport, and general aviation—utilizing to the fullest the brains among us, and we are sure to find that the complex problems of the Air Age are soluble.

Believing this, I should like to prophesy that this Air Force Association conference will be a threshold for the doorway leading to proper preparation for the Air Age.

As a private pilot and as a representative of business flying, I have been asked to envision some of the problems aviation may face in the Air Age. . . . I confine my remarks to the airspace problem. In making this choice, I am not unmindful of the fact that solutions are sorely needed to make our nation's airports capable of insuring necessary utility. Airport problems are as critical, as complex, and as variable as the demands of military, transport, and general aviation are complex and variable, often differing from locality to locality.

I am not unmindful that the *noise* problem must be solved. There is great need for better public understanding of and forbearance with noise during the time required to find acceptable solutions. Aviation's job in noise suppression is twofold:

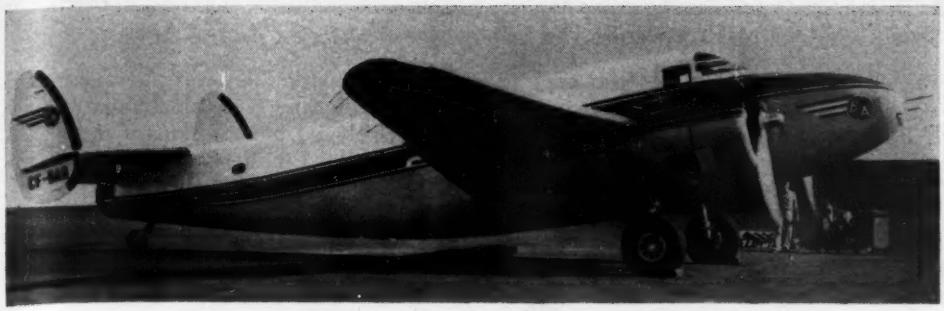
- Adequate and appropriate public relations.
- Full speed ahead on a course designed to lick noise with all of our technical means.

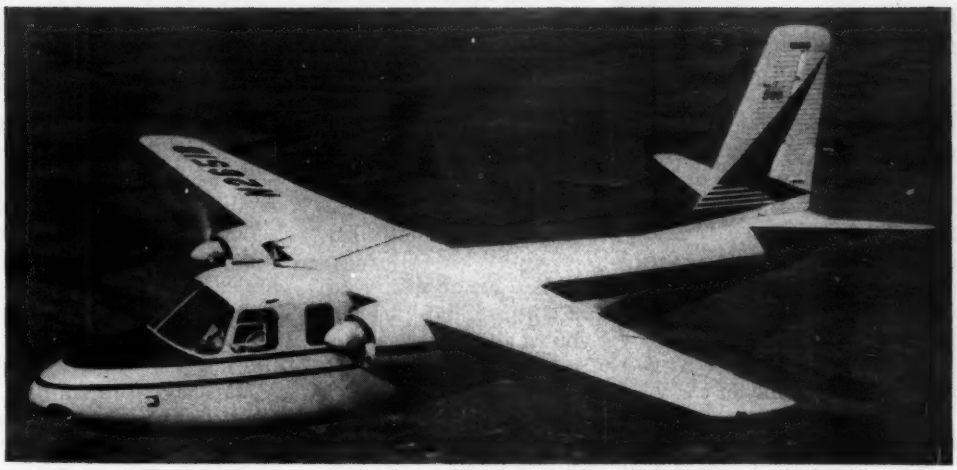
I have deep concern over the alarmingly evident lack of aviation interest among American youth. Here, too, it appears that aviation's public relations job has been weak in organization and in effectiveness. Our job at the professional teaching level, from elementary grades through schools of higher learning, must be vastly improved. We must more successfully encourage integration of aviation subjects in the school curricula.

It is evident that we have failed to arouse the curiosity, to stimulate the imagination, and to kindle the fires of inquisitiveness, desire, and ambition of present-day youth. All adolescents should want to learn to fly or bust; they should literally yearn to find out what makes airplanes "tick"; they should believe that there are untold opportunities for many types of careers in aviation.

Unless aviation earns and wins the hearts and the minds of today's youth, we may find ourselves in the Air Age without competent people to cope with it.

Of course, there are numerous other problems, includ-





In 1955, the number of business airplanes increased approximately fifteen percent. The Learstar, above, is typical of company-owned executive aircraft.

Aero Commander 560. Business-type aircraft flew 4,300,000 hours in 1955, 1,000,000 hours more than in 1954.

HENRY W. BOGGESS—*President, National Business Aircraft Association. Mr. Boggess is Director of Aviation for the Sinclair Companies and Manager of Personnel for Sinclair Oil and Gas Co. in Tulsa, Okla. A private pilot, he has been active in NBAA affairs for a number of years. He has been active in safety matters, serving as a member of the Board of Directors and Executive Committee of the National Safety Council for eight years. He has also lectured at several universities in Oklahoma. He became president and board chairman of NBAA in 1954.*

---

ing the joint use of public airports by military and civil aviation. But all of our problems, or facets of problems—airports, noise, education, joint use, and all of the rest—are actually minor when compared with the airspace problem.

I am fully aware that this is a very strong statement and that it is subject to challenge, but I submit to you that if airspace problems, including communication and traffic control, are not solved, then all other major problems of aviation will automatically take care of themselves and will more or less cease to exist!

At the present time there are probably only two things we know for certain about our airspace:

- *It belongs to all of the people and must be so utilized that it will serve all segments of aviation—military, transport, and general.*
- Our interests in the public air ocean are *collective;* that is, the problems belong to all of us, even though our needs are variable and individual.

At this very moment, relief is needed on several congested airways and in many control areas servicing high-density traffic. (The last time I went IFR [Instrument Flight Rules] from New York's Westchester Airport to Wilmington, I was compelled to take a Cook's Tour over most of New England. Even with crowded highways, it could have been driven by automobile in much less time.)

What will the situation be when recently ordered airline turboprops and jets are delivered, in operation, and are mixing with the ever-increasing number of piston-engine aircraft . . . and helicopters?

The picture is not good to visualize. What will it be to face in tomorrow's Air Age?

Maybe, instead of calling tomorrow the Air Age, we should call it the "*Anxious Age.*" The Anxious Age will be when we have a truly "*pressure loaded atmosphere,*"—and that is the place where if airplanes do not blow up, pilots probably will!

Let us look at the statistical facts: For 1955, the CAA reports a 22.1 percent increase in pilot position reports over 1954; a nine percent increase in landings and take-offs (19,600,000 of them). The airlines report a 1955 increase of nineteen percent in the number of passengers over 1954 (42,000,000 passengers). In 1955, the number of business airplanes increased approximately fifteen percent with an increase of one million flying hours (4,300,000 airborne hours for business planes in 1955).

Aviation has already begun to snowball and the Anxious Age is drawing near.

In the words of Gill Robb Wilson, "Are we dreaming big enough, thinking big enough, planning and building big enough to cope with the ever-mounting problems of our airspace?"

What tools do we have to cope with precise navigation, communication, and our ever-increasing air traffic? As of December 1, 1954, we had:

- Only twenty-nine Commissioned Airport Surveillance Radars;
- Only 216 VOR/DME Stations out of 425 programmed;
- Only seventeen ILS/DMEs out of twenty-two programmed;

(Continued on following page)

- Only 408 Commissioned VORs;
- Only 153 ILS installations;
- Only ten Precision Approach Radars out of a total of twenty-three programmed.

Are these enough tools? Are all of these the right tools for the Air Age?

From such information as I have been able to gather, it seems as though we are planning to enter the Air Age depending upon radar—*controlled from the ground*—to handle our traffic.

Maybe that is what we should do. I am inclined to feel, however, that the time will come when traffic control *from the ground* will prove inadequate.

Just how long ground control of air traffic may remain adequate from station level to 40,000 feet, handling aircraft from the slowest to the fastest, will depend upon development of several factors, not the least of which will be the volume of traffic to be handled. Reason seems to dictate the high probability of a saturation point—to an ultimate limit of how much air traffic can be controlled from the ground.

I am willing to assume that it may be necessary to control landings and take-offs from the ground through the foreseeable future. But, I ask you in all seriousness:

Should it always be necessary to control altitude level flight from a point *on the bottom of the air ocean?*

Maybe so, if we tie our thinking to "airways," which in themselves are factors of congestion.

Why "airways" forever? Today's super highways do not follow county roads.

Maybe our approach should be to think in terms of "airspace" instead of airways. After all, true utility of the air ocean dictates "direct routing"—the shortest distance between take-off and landing.

Direct routing would tend to unscramble and to relieve congestion . . . especially for through traffic once cleared from a high-density take-off area to a point near the terminal area.

You ask—and I ask—how can we insure IFR separation, vertically and horizontally, with varying speeds, by permitting each IFR flight to choose its own compass heading, to maintain its own clearance?

The question looks like a stickler—and it may well be—yet some electronic genius may be in this room, or in some small Kansas town tinkering with TV, or even yet on an East Side New York playground, who can come up with an airborne electronic box that *will permit direct and "individual" en route clearance under IFR conditions which will be infinitely safer than is present-day flying under VFR conditions.*

Such an airborne electronic box for every airplane could conceivably give a pilot "eyes" for perfect IFR vision and even eliminate the traditional VFR blind spots from above, to the rear, and below.

Such an airborne electronic box for every airplane could ceivably so picture "pips" that *speed*, from any angle or *direction, altitude*, and *distance away* could be accurately known instead of guessed and then misjudged as is often done by the VFR human eye. If such a magic contraption is within the realm of possibility, it would seem that we should be perfecting it if we hope to minimize airspace congestion, improve safety, and relieve overloaded ground controllers from their assignments at the bottom of the air ocean.

Sound fantastic? To most of us, we may react that the idea is an over-simplification of a very complicated problem. Maybe it is.

There is at least an outside possibility, however, that the idea is no more visionary than was the automobile self-starter when Boss Kettering was told to make it out of nothing. It is probably no more visionary than VOR would have been to Charles Lindbergh when he flew the Atlantic in 1927.

Our country has the brains, we have the labs, we have the materials, and we have the need for such seeming magic. Perhaps we would have to do no more than tell the scientists how really important such a little black box is to our future security and economy.

It could be that electronic and radar scientists will say that such an airborne, lightweight box to do such an involved job is out of the question and impossible. In that event we should look around for some crazy fellow who does not know that the job cannot be done; a crazy fellow like Thomas Edison who did not know that an incandescent light bulb could not be invented.

If not such a box, then what? Whatever it is should render "airways" obsolete, should free the airspace, unscramble congestion, insure safety, minimize ground control points, and reduce taxpayers costs—and it should be under way *now*.

And while we are thinking in terms of little black boxes, I sincerely wonder if all users of the airspace fully appreciate the value of all the tools available to us today?

We have present-day tools which are going unused that could go a long way in seeing us through today's transitory air traffic problems. Universal use of our available tools will do much for us while we are working to perfect and implement something better.

I have in mind VOR/DME. How many airliners, and military planes in our skies today, can make quick azimuth and distance fixes? To me, this seems much, much more important than to be able to turn on an X or a C band radar once in a blue moon to analyze a cloud!

Today's air traffic demands that each IFR aircraft has a positive fix in airspace.

VOR/DME can give it, and all aircraft entering high-density traffic areas under IFR conditions should have the equipment aboard.

As higher speed turboprops and jets become more numerous and mix more and more with our ever growing number of slower piston-type aircraft, quick and positive airspace fix will become all the more important.

VOR/DME is something we do not need to wait on scientists to perfect. It is available today; it is literally on the shelf, reasonable in price and dependable in service. Its universal use will materially improve our safety and minimize our congestion—today!

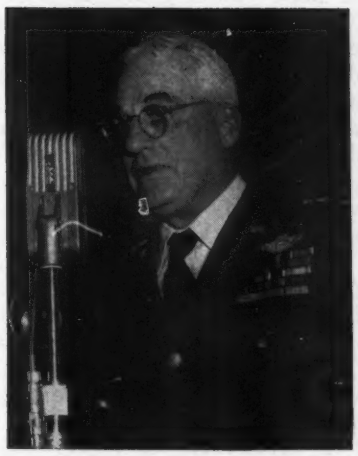
No time should be wasted in waiting to see whether TACAN—or something else—will replace VOR/DME. If TACAN does not, then something else will, eventually. Such is the price of progress.

We simply cannot afford to wait five, eight, or ten years to see how TACAN will prove out. This much we know: TACAN *is* experimental; there is a very reasonable doubt if it will make the grade; the experts say that it is more than five years away from full availability.

VOR/DME is here *now;* it is usable; it has been bought and paid for with taxpayers' dollars and with full approval of military and civil aviation and the Congress of the United States. It is more accurate than a pilot can manually fly.

VOR/DME can aid very materially in solving some of today's vital needs. It should not be cast aside and left unused by so many users of the airspace unless and until something known to be better is perfected, implemented, and fully ready to take its place.—END

the jet age



The Air Force in the Jet Age

Gen. Nathan F. Twining
CHIEF OF STAFF, US AIR FORCE

ALL of the concern about noise has generated from a relatively few number of complaints. Do you realize that of 6,000 airports in the United States, only about 250, or about four percent, are Air Force bases? If we add the airfields of the other services, we can say that five or six percent of all our airfields are military bases. Many of these bases do not have jet operations, and only a handful support supersonic operations.

The trouble we have had is nothing, compared to the trouble we could have, because aviation is tending toward more noise, not less. Long ago we foresaw this problem. We started noise studies, and noise abatement programs. Yet the complaints already received indicate the future magnitude of the problem.

Theoretically, we could move Air Force bases away from cities. Actually, we are trying to do this, but it will never be a complete remedy. We cannot even get enough base money to properly prepare existing bases to accommodate our modern, high-performance aircraft. You can imagine how much it would cost to build all new bases away from population centers.

Our criteria for future bases requires them to be located at least fifteen miles from the local community.

But this does very little good. Wherever you plunk down a multi-million dollar air base with a several million dollar payroll, local construction and service contracts, and local civilian employment, you will be surrounded by a rapidly growing community, practically before you even get an airplane off the ground. An air base is a big business. It makes the nearby cities bigger and it automatically generates communities where none existed before.

There are unlimited examples of this happening throughout the country. Tinker, for instance, was originally several miles from Oklahoma City. This is in no way a criticism of Oklahoma. Now Midwest City, a suburb of Oklahoma City, practically surrounds Tinker Field, and they have done a magnificent job in protecting Tinker Field and its surrounding area.

An example closer to home is Andrews. When it was built during World War II, it was comparatively isolated. Now Washington and its suburbs have grown completely out to Andrews.

Even if it were possible to build isolated bases and keep them isolated there would have to be two big exceptions.

Part of our air defense is necessarily based to protect population centers. To provide maximum-range, 360° protection to a metropolitan area, the interceptors must be based very close to that city. Any other policy would be like putting the city fire department out in the country.

The second exception is our Reserve and National Guard bases. We could not expect effective Reserve participation, if our Reservists had to use most of their limited time just trying to get to their bases. The major proportion of our Reservists and Air National Guardsmen live in or near populous areas. It is common sense that their bases be located nearby.

I might add that we are under constant pressure to give these Reserve components first-line equipment. We want them to have first-line equipment, because they would be of little use if they did not have it. But as we give these units first-line equipment, the noise of their operation gets louder.

Nevertheless, let me assure everyone that insofar as it

(Continued on following page)

is financially possible and tactically sound, we will continue to try to get our bases away from population centers.

There are other measures we can and are taking which offer better immediate and local help. Here are some of them.

You know the technical developments now under way. Several of these are projects initiated by industry. For ground run-ups there have been developed a whole gamut of Rube Goldberg devices to reduce the sound level.

Our Research and Development Command and our aircraft industries are spending lots of time and money to develop silencers or mufflers for jet engines. Unfortunately, many of the gadgets developed so far degrade performance. These are unacceptable since our margin of security depends on ever-increasing performance of combat aircraft. In flight, we have adopted time-consuming, fuel-wasting, and tactically inefficient traffic patterns both for take-offs and landings.

Community relations efforts to explain and keep the people informed really pay off. They do not reduce noise, but they at least make the reason for noise a little more understandable.

Our commanders, for instance, have had much success with what we call pre-conditioning communities. Before a combat wing moves into a new area, we explain to the local people what to expect and why our air operations are necessary.

The way these communities have reacted and accepted the minor inconveniences of better defense is a tribute to the understanding of the American people.

All of our present difficulties have been generated by the noise of jet engines of four to eight thousand pounds thrust. The noise of these comparatively small engines have already become a nuisance in some localities.

Now, let's look at the future.

Questions like these face all of us:

- What will the effect be of jet noise from engines of twelve, sixteen, twenty, twenty-five thousand pounds of thrust, which are not too far off?
- What will be the effect of hundreds of jet airliners operating in and out of population centers?
- What will be the effect when increasing numbers of light planes become jets?

As civil airplanes become jet-propelled, military aviation will no longer receive sole blame for jet noise. But that is no consolation, even to us. This noise problem will become one the whole nation will face—and I think you civil operators will find your choices of action even more limited than we are finding them in the Air Force.

For one thing, airliners will find it more difficult to play with traffic patterns. Air Force planes, even bombers, can and do execute sharp turns, steep pull-ups and so on, to avoid flying over communities near bases. I do not know what would happen if you put a load of paying customers through even a mild two-G turn, but I'll bet the outcry would drown out the jet noise.

Also, airliners operate on tight cost margins. You will not want to fly large, time-consuming, money-consuming traffic patterns.

Even more important—your business is carrying people and cargo. You can't find many customers in isolated areas. Your business takes you and your noise to the cities. For passenger convenience, the closer you are to the city, the better.

So what is the solution?

This is becoming a national problem. Military and civil aviation must work together to do everything possible consistent with security and progress.

GEN. NATHAN F. TWINING—*General Twining became USAF Chief of Staff in 1953. He received AFA's highest award, the H. H. Arnold Trophy naming him "Aviation's Man of the Year," in 1955. Born in Wisconsin in 1897, General Twining was graduated from West Point in 1918 and won his wings in '24. In World War II, he had tactical command of all AFs in the South Pacific, later headed the 15th AF in Italy and the Mediterranean Allied Strategic AFs. In 1947 he took over command of our forces in Alaska. He became AF Vice Chief of Staff in 1950.*

We should expend every effort to reduce disturbance to communities by routing, flying techniques, and mechanical silencers.

But I am afraid that these solutions will not be enough.

The big job is to get our nation to recognize this as a largely unavoidable consequence of progress. Gill Robb Wilson has pointed out that every technological advance has had undesirable side effects—and opponents of those side effects always try to stop our progress. Their efforts to halt progress always succeed in slowing it down, but they have never succeeded in stopping progress.

Noise is just something we are going to have to live with. The American people will eventually understand this. We must do all we can to speed this understanding.

In fifty years we have learned to live with the stench, noise, expense, death, and destruction of the automobile. I doubt that noise will cause the destruction in a hundred years that the automobile does in one.

While there is a frightening death toll on the highways, there is not a one of us who does not value the automobile. We may not like its by-products, but we have learned to live with them.

I foresee the same acceptance of the undesirable side effects of flying. It is conceivable that the airplane will affect our way of life just as has the automobile. Homes may be designed sound-proof—boom-proof. Communities may grow away from centers of air activity.

Now, as far as the Air Force is concerned, let us look a little further into the future. We are getting into the field of short take-off and landing planes. We are developing zero launchers to get aircraft airborne, and mats and barriers for landing. We are getting boundary layer control and reverse thrust. The vertical take-off aircraft is coming. All of these will alleviate the noise problem because they will get us up and down faster, and make it easier to stay away from communities. Like all new developments, they will probably bring on new problems we haven't even imagined yet.

Looking even further into the future—we are getting more and more into the missile business. Eventually, a great proportion of our defense and offense will be in place, poised—ready-to-fire—missiles. Let me add, parenthetically, that this won't happen until missiles are as dependable and efficient as pilots. This time is coming, but it's not here yet. Now, these missiles won't make a bit of noise until we need them—and at that time we'll have other things to worry about.

To sum up my remarks on noise—it's a growing problem. It will be handled partially by our noise-suppressing measures. The end answer is acceptance. We must not only pre-condition communities, we must pre-condition the nation.

I just wish our jet noise were our only problem. To me the echoes of Communist H-bomb tests obliterate the noise that comes from building defenses against them.

Interceptors, like this Northrop F-89D, must be based near cities in order to provide maximum-range protection.

So far the public has objected to noise primarily because it is a nuisance, not a hazard. I believe we will be able to keep it from being considered hazardous.

Other Jet Age problems *will* be the result of public concern over danger. There are several of these. Problem areas include air traffic control, congestion at and near airports, and heavy landing and take-off traffic over populated areas with the increased potential for tragic accidents.

Most of these are problems shared by civil and military aviation. One, however, is peculiar to military aviation. I speak of the weapons carried in aircraft.

It is only common sense that whatever weapons our Air Force uses must be readily available. Instant readiness means survival.

The Air Force has been in the nuclear bomb business for over ten years now and you may be sure that full attention has been given to every detail of design and methods of handling required to eliminate the possibility of an accidental nuclear detonation of the weapon, either in the aircraft or on the ground. You may readily appreciate that an aircraft crew would be hesitant to fly a vehicle unless the hazard to them of an accidental detonation was essentially non-existent. With this built-in safety, the worst condition to be expected would be the hazard associated with conventional high-explosive weapons. These safety features have been, and will continue to be, tested realistically, to assure that the chance of an accidental nuclear detonation is so remote as to be incalculable.

Even though our weapons have an extremely high degree of built-in safety, our handling of any kind of weapon is super cautious. Machine guns, for instance, are not charged until the aircraft is in an area where they can be safely fired.

External rocket connections are not hooked up until the aircraft is in take-off position—pointed away from all populated areas. It is standard procedure for aircraft carrying any kind of ordnance, even small practice bombs, to fly many miles out of their way to give a wide berth to all towns or villages.

The point is that handling and carrying ordnance, from bullets to A-bombs, is potentially less dangerous than many other operations. It is not, and will not be a major problem, to conduct these actions in safety.

The last topic I wish to include in my discussion of *future* operations is the nuclear-powered aircraft. I want to allay any fears there may be about hazards in operating this type plane. A nuclear engine will be merely a new form of propulsive power. Our sister service, the Navy, has been operating a nuclear power plant in its submarine, the *Nautilus,* with safety and dependability. The controls built into a nuclear engine will make it no more dangerous than any other engine.

By no means let anyone be confused. Nuclear weapons and nuclear airplanes are not synonymous.

Actually, our hopes for peace and progress rest, to a large extent, on this big difference between a nuclear bomb and a nuclear reactor. The bomb could, in many ways, darken the world. The reactor could eventually light the world.

The nuclear-powered aircraft will not be solely an instrument of war. It would be developed even if the threat of war were buried forever. It is a step of progress that is as inevitable as the nuclear power plants that generate electricity, or nuclear-powered ships.

There will, of course, be new problems associated with the operation of nuclear power plants. A great deal of our research in developing nuclear power plants is devoted to finding out what these problems will be.

You have read of the airborne nuclear reactor now being tested in an Air Force B-36 based in Texas. These are the first flights of an actually operating reactor. The reactor presently provides no propulsive power. It is running simply so we can test its effects upon the components of aircraft in flight.

This is one of the means by which we are determining the potential problems of nuclear flight in order to be able to whip them before they ever become real problems.

These flights will also enable us to design safety procedures for nuclear flights.

Actually, there are many ways in which nuclear flight could be much safer and even less hazardous than conventional flight. Theoretically, nuclear engines can be the most dependable engines ever made. Engine failure in flight and during take-off or landing should be almost non-existent.

Even a greater safety advantage is the nuclear plane's boundless range and flying time. These days, bad weather combines with definite limitations on aircraft range and endurance to become a major cause of accidents. Imagine the day when a pilot can have an unlimited choice of alternate airfields, or an unlimited time to circle and wait for the weather to improve.

The same qualities will help to solve another problem that is being discussed in this conference. That is air traffic control. Everyone agrees that the high speed and high fuel consumption of jet airplanes is completely incompatible with our present air traffic control system. Planes with unlimited range and endurance will certainly be welcome in any system of control and will never be a problem.

Our main problem overshadows all the difficulties I have discussed here today. Our biggest problem of the future will be the same as it is now. That is, to keep American airpower able to do its job. Solving the difficulties we are discussing here will certainly enable us to do our job better.

I think the Air Force Association is to be congratulated for its foresightedness in organizing conferences like this. These meetings of civil and military aviation leaders will certainly point the way to keeping our airpower superior.—END

the jet age

What are we doing about the Noise Problem?

A FORUM

AFA's Noise Abatement Forum was moderated by James H. Doolittle. Members of the panel were Dr. R. H. Bolt, Dir. of Acoustics Lab., MIT; Vice Adm. C. E. Rosendahl, Exec. Dir., Nat'l Air Transport Coordinating Committee; William Littlewood, V-P, American Airlines and Chairman, NACA Subcommittee on Aircraft Noise; Dr. T. L. K. Smull, Chief, Research Coordination, NACA; Dale D. Streid, Mgr. Preliminary Design, Jet Engine Dept., General Electric Co.; Dr. H. O. Parrack, Technical Director and Coordinator, Noise and Vibration Control, ARDC; Capt. C. P. Phoebus, Special Ass't for Bio-Sciences, Office of Naval Research, USN; and Dr. H. C. Hardy, Ass't Mgr., Physics Dept., Armour Research Foundation. Since there were no prepared texts, minor editorial liberties have been taken.—The Editors.

DR. BOLT: I would like to approach the noise problem in a non-physical way. Perhaps many of you have been at Niagara Falls, maybe even on your honeymoon, and wandered around close to the falls. Did it occur to you that you were exposed to more than 100 decibels of noise? Or, have you ever tried to go to sleep on a hot summer's night and heard a faint little *buzz, buzz, buzz, buzz*? That is only about 20 or 25 decibels but it can sure raise cain with your sleep. In other words, decibels alone do not measure anonyance. The fundamental problem is one of human reaction to noise—to what extent does the noise interfere with your normal living? The mosquito wakes you up, so its noise is annoying.

The decibel measures the sound at a particular point. Actually, the more fundamental measure of this sound is the total power that is coming out of the source, how many watts or thousands of watts. As the mechanical power of a device increases, so does the acoustic power, but there is a little important number, the efficiency.

Many devices are used on automobiles, trains, etc.—only about one part in 10,000 becomes noise. But jet engines are getting pretty efficient. They can put about one percent of their power output into noise.

Dr. Parrack: I would like to point out that in planning its research and development, the Air Force has found it necessary to take a kind of systems approach. We call it an acoustic energy system. The sources of noise are the pieces of equipment, aircraft engines, or other that produced the sound energy. This is released in the immediate vicinity of the operating piece of equipment. It then passes through an immediate area, structure, or some other material for a greater or shorter distance. This is a transfer pattern, an energy transfer system. This leaves the energy to an environment in which a receiver is located; the receiver may be the airframe structure, but most often and in most of our complex problems, the receiver is not the structure—it is man and man as a response mechanism stimulated by acoustic energy.

Mr. Littlewood: We refuse to accept the edict that nothing can be done [about noise]; that people will just have to get used to it. Frankly, we know from surveys that people do not get used to noise; that most complaints come from the people who are subjected to noise the longest, so there is not much hope in that direction. I think you can ameliorate a situation by excellent public relations, but you cannot hope for miracles.

In military circles, I will agree that the problem is a little different, and I have coined a few words which I think fit the fundamental problem. The noise problem of the Air Force, as well as many other problems other than noise, is perhaps epitomized by the word "isolation." Private airlines, I think, segregate the word. As far as commercial aviation is concerned, the words are "juxtaposition" and "noise reduction." That is what we are working on and we are going to achieve it.

Mr. Streid: We at General Electric Company in Cincinnati build the jet engines that make the noise, and we have had, over the past few years, a great deal of experience, both with the noise that these engines make and with the handling of this noise in a fairly large community. We have, within two or three miles of our plant at Cincinnati, 30,000 people living in a high-class residential area. We have succeeded in lowering our complaints, from about 124 in 1952 to less than one complaint per month at present.

There have been a number of reasons for this. The first reason is the acclimation of the public to the noise and to the nature of the noise. Secondly, we have better relations between our plant and the people and a better understanding on their part of what we are doing and what the jet engines do.

The next step is better sound treatment even with bigger engines and afterburners. We have succeeded, by improved techniques of design and construction, in reducing the amount of noise that we are putting into the surrounding community by a great deal.

Finally, and strangely enough, we find that reduction in night running improves our community situation. People do not seem to worry as much about noise in the daytime as they do at night.

Dr. Smull: Aircraft noise is one of the most complex and difficult problems that the scientist has ever been confronted with. It not only involves the physics of where the noise comes from but, as Dr. Bolt mentioned, there is only a small portion of the energy of the jet engine —maybe anywhere from one to fifty parts in a thousand— which goes into the production of noise. This is the proverbial needle in the haystack.

There is much work on this problem on the scientific front, attempting to sort out these facts regarding the

development of noise in the engine and the various noise sources around aircraft. Some of the techniques show some promise. We have no final answers at the moment, but I am sure that reduction will be achieved that will not seriously penalize the airplane.

Captain Phoebus: The Navy has all of the problems of noise that the Air Force has plus a very special tough one of our own; namely, the problem of operating jet aircraft off of carriers.

In this carrier situation, you cannot get away from noise. When we are operating our planes ashore, as the Air Force does, there are not too many people exposed to the terrific force of the initial take-off blast of these planes. The plane goes out to the end of the runway and it is somewhat isolated, but this is certainly not true on the decks of our carriers, and it is especially not true for the boys who are operating our catapults.

The Navy, up to the present, has been working on this problem hand in glove with anyone and everyone that we can—with the Air Force, with the engine manufacturers, etc. We have now come to the point where central control of all the effort in this area is required and necessary.

I would like to change the subject a little bit. You heard mention made of the Armed Forces National Research Council's Committee on Hearing and Bio-Acoustics. There are four members of the Executive Committee of that Council sitting right here at this table. They are Dr. Bolt, Dr. Parrack, Dr. Smull, and myself. We have at our disposal the best brains in the country through the National Research Council, through the universities, through the commercial organizations, etc. The way it operates is for the Armed Forces representatives to receive the problems in the area of noise that generate within the services, pass them on to the Secretary and from there to the Executive Council where we digest this problem and appoint working groups. So far, the results have been very pleasing to the armed services, and, I think, to everyone else.

Dr. Hardy: I would like to speak of the relative magnitude of the airplane to the noises of other things in the community by talking in terms of the output of various sound sources. As I speak to you, I am putting into this microphone the order of 3/30 millionths of a watt. This is being amplified by the public address system, so there is something like 1/10 of a watt being put out into this room. About ten watts is put out by a truck going down the highway under load. The noise of diesel locomotive is about 100 watts. You go up to something like 1,000 watts with an commercial aircraft at full load and take-off, and you get up to 10,000 watts—that order of magnitude—with the present type of jet airplanes, and you will get up to 100,000 with jet airplanes of the future. This is a tremendous range of energy. As a matter of fact, if all of the people in the world were talking at one time, they would make the noise that one B-52 airplane makes.

There is also a tremendous human range of acceptance, and this is one of the biggest acoustic engineering problems of all. There are legitimate, honest complaints where there are only thirty decibels being put out by a particular industry. On the other hand, people live alongside the elevated tracks, truck routes, and railroads where there are eighty-five decibels. I think one of the best ways to compare these relative sound sources is on the basis of how far away they would make eighty-five decibels. The truck you can hear about seventy-five feet away would be about eighty-five decibels. The diesel locomotive would be about 200 feet away and the airplane about a mile or a mile and a half away. Fortunately, people live further away from airplanes as a rule than they do trucks, so I think this may give us a little perpective.

General Doolittle: To open the panel discussion, I will ask a few basic questions. What creates aircraft noise and, as a corollary, what is the relationship between aircraft noise and engine thrust?

Dr. Bolt: Noise is generated by anything that starts air moving. A loud speaker cone going in and out puts sound out into the air; a propeller blade passes through a certain point in space, pushes the air aside and as successive blades pass by the same space, there is an oscillation of the air and you have a noise. Under most operating conditions of a jet engine—certainly about eighty percent or so of power—the large majority of the noise is actually generated outside of the engine itself, from a few feet back to ten or twenty feet back of the tail pipe, and the large amount of noise that is put out—that is, the large fraction of total power—is generated by the pure turbulence complicated by motion in the jet stream.

One of the interesting things about any particular sound generator, in addition to how much power it puts out, is what kind of frequency spectrum it is putting out, such as low frequencies that rumble and roar or high frequencies that scream and whine.

Another important factor is this: In what directions do they put this sound out? In general, any source of sound has some frequency characteristics and some directionality characteristics. Jet engines have a strong directionality characteristic. The noise comes out 45 degrees from the axis to the rear. The sound at some standard distance, say 100 feet, away from the measured distance in the 45 degree region, can be twenty or thirty decibels stronger than the sound measured directly aft or directly ahead of the airplane. This is very hopeful from a noise control point of view. If you can take the power which is now mostly irradiated in one cone and redistribute it, it is going to drop the level everywhere, and several of the gadgets that are now being developed as possible noise suppressors tend in the direction of redistributing the energy, knocking down this peak. Also, some of these devices redistribute the energy in the frequency scale. They take some of the roar and rumble and put it up in the higher frequency range. You might think the scream is more annoying, but there is another point here—the higher the frequency, the more rapidly the sound is lost, dissipated as it moves off to a distance.

Perhaps I should add one more comment with respect to the relation of thrust to noise. If we are now up to 8,000 pounds of thrust in a conventional jet, and we are expecting, say 25,000 we will have roughly three times the thrust. This is going to increase the sound level at some standard distance by perhaps the order of fifteen decibels—somewhere between ten and twenty depending on just where you are—but a difference of twenty decibels is not necessarily a very large volume.

General Doolittle: What is the extent of noise penetration under average conditions— how far would it spread out from a noise source?

Dr. Hardy: The noise just does not propagate out smoothly. The noise will fluctuate about twenty decibels at 1,000 feet, if you measure it in a very short time interval. When you try to make noise measurements, you get into noise fluctuations and other complicated problems. The sound drops off proportionally to the area that it radiates through. This means that the sound will drop off six decibels for double additions. Under certain conditions of meteorology – rather prevalent conditions – it would be much less; it may be eight or ten, and the high frequencies will drop off much more rapidly than the low frequencies. That is why thunder at a distance sounds like a rumble and thunder at short distance sounds like a crack. The crack represents high frequencies; the rumble of thunder represents low frequencies, and all of

(Continued on following page)

the high frequencies will go out half the time. People object very strongly to the high frequencies. Also, sound drops off over the terrain, due to some absorption in the ground but chiefly due to temperature variations. These facts are now being measured by the scientists in order that the airplane and airport planners, and so on, will have better data in the future.

For example, putting up a row of trees will not do much good at all. If we have enough trees, 100 feet in depth, some good may be accomplished; more good is accomplished by the rolling terrain than the shrubbery.

General Doolittle: What are some of the other factors influencing noise propagation?

Dr. Hardy: I think the most important factor is people. The acceptance of people is a very big item. In the future, I think a lot can be done by education, to get people to accept the noise. After all, there are trains running through some of our best suburbs and they make considerable noise. We have people building their homes along truck routes and they never complain about the noise, so perhaps the level of people's acceptance in the future may be higher than than it is now. However, as you look over the thing, you can make the most optimistic prediction of how much people will accept; you will find up to a mile away from airports or a mile away from runways is pretty bad. There may be complaints up to four miles, too.

Captain Phoebus: I would like to elaborate a little bit on this human factor, if I may. First of all, the kind of noise we are talking about now is something new in human experience; there is nothing in nature capable of producing the kind of noise that we are now producing with our jet planes and missiles. This has complicated the problem of understanding the effect on man and of protecting man against these effects.

Consider the fact that about 140 decibels of noise is the threshold or perhaps more than the threshold, and almost everyone is going to feel pain at that level; as a matter of fact, he is going to feel more than that. He is going to feel frightened and apprehensive and his greatest urge will be to get up and run. This poses some problems when you are doing research on the effects of noise on man. In the first place, you have to deal almost entirely with animals because you cannot subject man to something that he cannot tolerate.

In the second place, almost all of the work that has been done on the effects of noise on man up until recently was done at a level below what we are talking about, because there were no noise producers capable of producing the environment we wanted to study.

We are approaching the problem from a number of angles. We do know a great deal about how to protect man. I think it is safe to say that we have already gotten up to the point where we can put more protection on them such as earplugs and other devices than a few years ago was thought theoretically possible. On the other hand, you cannot have your whole population running around with earplugs or helmets, so the community aspect of it is rough.

Mr. Littlewood: Those remarks, I think, point up the crux of our problem, which is that the only answer to this problem is reduction of the noise at the source. We are faced with many variables, two of which are our power plants having thrust and the energy-generating characteristics which possibly include an element of noise. These are going to be bigger in the future and our operations are going to be more frequent, and those two factors contribute very much to the lack of reasonable acceptance by the general public.

General Doolittle: What is the relative noise factor in ground and air operations of first, current military aircraft; second, advanced types and series of military aircraft; third, turboprop transports, military and civil; and, fourth, commercial jet transports?

Mr. Streid: All of our current and future advances in aviation in such things as speed, size, range, and altitude depend on getting more power for propulsion. The only way we now know of to get this additional power is by the use of jet engines. I would like to show you that the jet engine is not the basic cause of the noise problem.

The current noise problem is the result of the increased power which is required for the speed, the altitude, the range, and particularly the size of the current and future airplanes. However, for the same power, a propeller-driven airplane would generate substantially more noise than an equivalent jet airplane.

Admiral Rosendahl: I am led to believe that there may be some progressive increase of acceptance, maybe, as the younger generation grows up and they are more interested in the airplanes themselves and they are more accustomed to the noise; but we are a little more optimistic about what our civil airport neighbors will have to endure.

First of all, there aren't any civil jets in operation yet, so what are we doing? We are more or less anticipating trouble. I think it is a very important factor that industry has all of these brains at work in trying to solve the problem before it really arises.

Another significant thing is that we are not going to have enormous numbers of turbojet transports, at least not for a long time. There are only about 200 in prospect for the next six years. Then, of course, no one yet, as far as I know, in the civil air transport business has even suggested the use of an afterburner, and I think we all agree that the afterburner is very frequently the villain. So, I am not too pessimistic at all over the ability of the industry to come up with a satisfactory suppressor by the time we get these things into service in any kind of volume. And these are more far-ranging, long-range developments that are now in the stage of research which give better promise than what we have to begin with.

General Doolittle: What can be accomplished by ground operations control, and what can we accomplish by flight operations control?

Admiral Rosendahl: In general, the military services and the civil air transport industry are using pretty much the same sort of remedial procedures that one can employ in this noise abatement program short of actual control of the noise at its source. Those procedural things are simple to understand. They involve the use of preferential runways which lead out over water or open areas whenever the safeguards that we are to set up permit.

In a civil air transport system where we have a wide range of planes of different capabilities, obviously you cannot set the criteria for the strongest plane, the one which can take the strongest crosswinds; we have to set them up for the weakest link in the chain. By and large, the preferential system has resulted in a considerable amount of relief.

Then, we have accelerated climb procedure which was worked out by time association by the Air Transport Association for each type of transport that is in use, and by very reasonable measures, the rate of climb out is accelerated. We have set an arbitrary value of 1,200 feet over the ground as the altitude that our civil pilots try to obtain as soon as possible. On landing, they hold 1,200 feet as long as they can. Then, of course, we try to reduce the number of low-drag, high-powered operations.

We removed training flights on the order of something over 25,000 a year to outlying airports. The only training flights made at our municipal airports are those which are required to be made by authorities, although we do find it is preferable to climb straight up to flight altitude rather than turning, because when you turn, you spread the noise. We depart from that in special instances. But these remedial measures are limited in this application.

General Doolittle: Just one more thing. With respect to ground run-ups, of course. I think everybody operating an airplane does the same thing, and that is the only thing he can do, in general, until you get the adequate suppressors for them, and that is to use your ground installations buildings and structures and things of that kind as barriers as much as possible.

While we have not worked out anything elaborate, nevertheless, a reasonable system of telling each airport operator where he can run up certain powers at certain times and that sort of thing would be very helpful. In other words, we control the locations at which these maintenance run-ups can be done. In essence, the remedial measures are based on the laws of inverse squares, getting the source of the noise as far away from the airport as we possibly can.

Mr. Streid: I would like to report a little bit on our experience over the last five years with these jet engines at Cincinnati. Our most successful measure, as far as community public relations has been concerned, has been by means of a monitoring system which we have established. We have tried two kinds. One, we set a permanent monitor on a telephone pole about two miles from our plant, right in the center of the heaviest residential district. This a fairly inexpensive way to monitor the sound, and it has been in operation for some time now and quite successfully. We find it has two drawbacks, however. One is that sound has a habit of bouncing around, depending on atmospheric conditions, and the worst spot for a given source—and we are a fixed source at our plant—can easily move around five or ten miles depending on clouds and weather conditions, and a fixed monitor really does not catch this.

The other thing wrong with it is that it is impersonal. People see it on the pole but they do not know whether it is working or doing any good or helping.

We have another method of monitoring which has been much more successful, and it has satisfied both of these problems. We have a monitor mounted in a truck that travels around the community, and it can drive up to anyone's front door, measure the sound level and tell you what it is. This sound truck is equipped with a radio communications system through the regular Bell Telephone System and does keep in direct contact with the plant. We can call back to the plant and have them shut down the power until it reaches a tolerable level. It is a more effective way of monitoring the sound and it has been successful in reducing the complaints we have had from the people in Cincinnati.

Admiral Rosendahl: Let me commend the Air Force for the public relations program that they are undertaking. I have seen some of the literature which they have put out. We, of course, have learned in dealing with the public that a good educational, public relations program is a very important and essential element to this whole thing.

Our organization comprises not only carriers, airport operators, pilots and CAA but also CAP, the Aircraft Industries Association, Air Transport Association, every element in the civil air industry. The fact that the public knows that there is this unanimity of effort in their behalf makes them a lot more tolerant of the situation, and they will go along as long as they know something is being done. Therefore, I cannot stress too strongly the great value of educational and public relations programs.

General Doolittle: What can be accomplished by silencers on aircraft?

Mr. Littlewood: I would like to point out, first, that technical attack on this problem is not very old. Noise as a recognized nuisance has increased with our industrial activity, our flight activity also, and we have only attacked the problem recently.

We want to acknowledge our great debt to British research. A man named Dr. M. J. Lighthill in the last five years has promulgated the first fully generated theory of sound in the turbulent mixing of jet exhaust, so you can see how young the scientific attack on this has been.

Also, researchers abroad, such as Lilley, have worked on a small scale. F. B. Greatrex at Rolls-Royce has also been doing some work. They developed principles which we are applying very successfully. Greatrex tried teeth around the jet exhaust, and he tried to increase the frequency, possibly depreciating some of the noise energy, but, in general, to increase the frequency to bring it up into an area where attenuation would be more effective. He expanded from tooth exhaust to corrugated exhaust, various amounts of convolutions going all the way from three, the minimum, to forty or fifty as a maximum. All of this resulted in a terrific increase in perimeter exposed to this jet stream which was undergoing the turbulent mixture with the passing of air of lower velocity. The net result was that there was an apparent absorption of sound energy, at least a substantial change into the higher frequencies, some of which may have lopped over into the ultrasonic area where you could not hear it at all.

Also, researchers at Boeing disclosed last week reductions up to the thirty-five decibels which had been achieved by configurations, which are perhaps not practical to use for flight but this is a step in research leading to ultimate victory.

Douglas has achieved great success, too. They are working up and down the coast between Boeing and Douglas to find out whether the decibel readings are consistent, who has the most, and how they got it, and everybody is going to use the information, whoever finds it, so we are well on the way. The theory is that the noise which comes out of a jet exhaust becomes a function of the square of the diameter—more thrust, more noise.

The other significant factor is the eighth power relationship with the higher speed in the jet exhaust. In efforts to reduce noise by that method, we go to reduced exhaust velocities and the by-pass engine, which I think permits much more consideration in our research and development program in the United States. Rolls-Royce has one at Conway that produces a lower jet exhaust for a given mass flow or momentum flow and, therefore, effectively, reduces noise.

Douglas is working on one method of reducing the noise by reducing the net effect flow out of the back of the engine. Of course, these are all ways which the military cannot use. You have to be willing to sacrifice a little jet thrust in your maximum thrust output in order to achieve these benefits. Greatrex was in favor of no reduction, but he had to accept a little bit, perhaps one percent, and we are striving to stay at that value. Up to that point, we in aviation can accept some reduction of thrust for reduction of noise. Perhaps in the military that cannot be done.

I would like to say one other thing. As we have extended our researches in noise, it has become increasingly evident that there are many associated problems. For instance, when we get rid of jet noise, we are going to find we have a substantial intake noise of an irritating

(Continued on following page)

nature. Perhaps you have noticed a whistle in the flight of turboprops. It is of a character that is irritating, not to the degree that it is annoying, but it can become annoying with engines of that characteristic. You hear the high frequency whine out of the jet. We are going after that. There are also gear noises in the turboprops. There are also accessory noises, combustion noises, compression siren noises, etc. We are going to have to do something about all of them and we are working on the maximum one, the jet noise.

Some other effects have been noted, not only on people but on structures of aircraft. The Comet experienced substantial destruction from the exhaust. While this cannot be associated directly with noise, nevertheless, in close proximity or under wing areas, you do have a tendency toward fatigue failure of the structure, which requires beefing-up or, probably as a compromise, the addition of a noise suppressor with additional weight.

The other thing that is coming into prominence is the effect of noise and vibration on equipment—the sensitive relays, the sensitive electronic tubes. So, there are many reasons to stimulate us to reduce noise at its source.

Dr. Bolt: Perhaps I should add a word about the decibel. Mr. Littlewood mentioned a reduction of ten decibels. You might think offhand that if you start at 120 and knock it down to 110 it is not a big fraction, but it is a logarithmic scale and every time you drop ten decibels, you have thrown away nine-tenths of the energy. There is a tenfold increase in power when you go from 10 to 110. That is true up and down the scale. Any device that can knock off nine-tenths of the power is doing pretty well physically.

General Doolittle: How do military requirements, compared to commercial requirements, affect the noise problem?

Dr. Parrack: I think that perhaps we cannot be as optimistic about the use of the various new developments of suppression at the source as can the commercial operators. Perhaps the commercial operators can tolerate some losses in performance, but the military operators cannot possibly tolerate loss in performance.

On the other hand, I do not think we should be entirely pessimistic about it. At present we are having to increase weight in aircraft to withstand pressures applied to structures by the sound field generated by the power plants. It is possible that we can trade the beefing-up of structures for the additional weight that is required to build the noise suppressing type of nozzle.

We have, I think, the requirement for being somewhat farther away from our most densely populated areas, with our military operations. We can move away but there is still the need for noise suppression. It will take careful, thoughtful, unemotional future planning, agreements, and a real wish and willingness to abide by these agreements to use this method effectively in isolating military operations. In contrast to this, commercial operations, to accomplish their job, must be closer to densely populated areas.

If we want to look at another figure, ranging from the threshold of your hearing—the weakest sound you can hear—to the sound fields in which our maintenance personnel work, we get a figure for that ratio. Our maintenance personnel work in sound fields something like one and a half billion times the threshold of human hearing. To reduce the acoustic energy by one and a half billion times is a very serious physical problem.

Now, there have been some statements made about the effects of sound on personnel. Most of these statements were made with respect to maintenance personnel. There are some effects on men which I think we can say will not happen if those men are located outside our air base facility. They will not happen to our own personnel who are in quarters at any reasonable distance from our operating facilities. The sound fields to which these people are apt to be exposed, as far as I can see now into the future, will not cause mechanical damage to the human body or any of its parts.

Captain Phoebus: I want to emphasize once again the problem we have protecting our people who must be exposed to high-intensity noise, those within the base, those on the carrier, those on the maintenance line, etc. It is not enough really to talk about disturbance of rest or speech interference, but we have to talk about actual physical damage to these people. We have gone a long way in protecting them. The problem is largely to stay ahead of the increased noise that our engines are putting out.

Our major concern is not focused on a pilot. He is in a pretty good spot. He has on earphones, a helmet, and he has a cockpit enclosure and, best of all, he is situated in the distribution point of the spectrum of noise where he is not so apt to be exposed to it.

General Doolittle: How much research and development is now being devoted to the noise reduction problem, and is this amount adequate?

Dr. Smull: The problem is to get reduction of noise at the source. This is the focal activity of a great share of our research at present. It is the crux of the problem, particularly the flight problem. We have our noises on the ground. We can contain them in some way. You heard Dr. Parrack say that we are looking for a reduction of one and a half billionth, so the research man has his problem cut out quite fairly and squarely. The NACA has a broad research program on these problems both at its Langley Laboratory and its Lewis Laboratory, and is gaining more and more insight as to what is happening in the tail pipe. As Dr. Bolt said, the principal source of the noise is being generated behind the airplane, and we are learning more and more about the mechanism and what can be done about it, how we can sort out the various frequencies to help suppress the noise or reduce it. We are learning things right along. Some strides have been made—things we thought were good yesterday are no good today, but, as Mr. Littlewood mentioned, the corrugated or the Greatrex nozzle now is a baby that has been born. He is real healthy, and not only the NACA but the industry and various other groups are working on these various devices and schemes and methods in the hope that we can get some good, healthy, strong men out of it.

On the development side, the Air Force has a broad program of research under way both in their laboratories and elsewhere. Out at Wright Field today there is a fine new acoustical laboratory under construction. They have a great deal of work being contracted for in various scientific and education institutions around the country, such as at Dr. Bolt's laboratory at Massachusetts Institute of Technology, Dr. Hardy's group at Armour, all of whom are working on this.

The aviation industry has been quite active in this problem. The Aircraft Industries Association had their noise control committee working with the industrial problems of industrial noise. Mr. Streid has presented some results of some studies that have been made out at General Electric. Pratt & Whitney has a very active program. Wright Aeronautical Corporation and all of the other engine companies are aggressively attacking this problem and, last, of course, the airframe companies themselves are working on these

(Continued on page 131)

the jet age

Flying Safety—The Military View

Brig. Gen. Joseph D. Caldara
DIRECTOR OF FLIGHT SAFETY RESEARCH, USAF

As THE Director of Flight Safety Research, my mission is to conserve the combat capability of the Air Force. In the next few minutes, I hope to put into some sort of perspective what aircraft accidents mean to the combat capability of the Air Force, what they mean to you people, and what they mean to all the civilians of the United States.

To put this into some kind of a frame, I would like to go back a little bit. We have heard some comments from General Partridge and others on the long-range accident trend. If you go back some thirty years you will find that our accident rate was pretty high—510 per 100,000 flying hours. Over a period of time, it has dwindled down, and for calendar year 1955, as of 31 December, our figures look like 17.2 major accidents per 100,000 hours. This is the lowest in the history of the Air Force.

Involved in this general decline of accident rates, though, are a couple of important things. Instead of the line going steadily down, there is a jog where it goes up. The air mail incident in 1934 is one example. The air mail incident and the increase in the accident rate prove that if we try to do something when we do not have the equipment and the training, we can sure tie it up—and we did on the air mail. The accident rate went up.

The expansion for World War II forced upon us ten times, a hundred times, a thousand times—new aircraft, new procedures, new facilities—and we were not too sure how to operate or manage this equipment. Until we learned how to manage the equipment, again the accident rate went up.

In conjunction with this, there is something else to note in this long-range decline of accidents. That is the fact that fatal accidents per 100,000 hours have gone down to an all-time low of four. This is important to the Air Force; it is important to the combat capability of the Air Force.

There is the possibility that with the development of new equipment today—the Century Series aircraft—unless we move in and prevent it now, we could see the accident rate go up this year, because the aircraft today far exceed the capabilities of the pilot. By this I do not mean to say that our pilots cannot handle the equipment; they can, but there are some things that we are going to have to learn to do to handle this equipment. So much for the over-all accident rate.

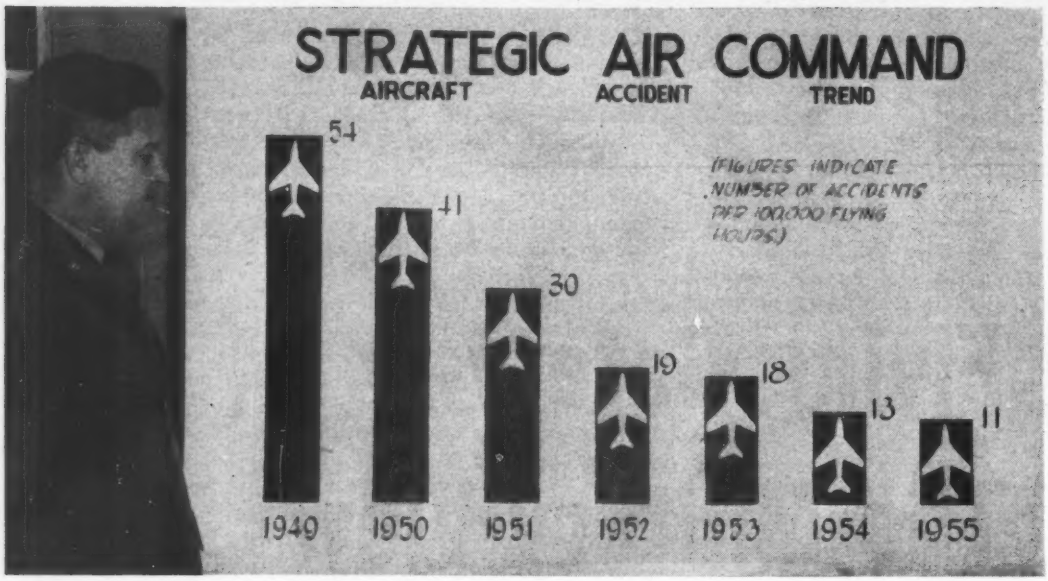
In order to conserve the combat capability of the Air Force, we have to know where and what type aircraft are involved in accidents. As you probably know, jet fighters and jet trainers account for over half of all of the major accidents.

In 1950, when the Air Force was becoming a jet air force, the jets were flying only one-tenth of the flying time and accounting for one-third of the major accidents, one-third of the fatalities and one-third of the dollar losses. In the five years since 1950, jets have multiplied their flying time by three. They are accounting for almost thirty percent of the flying time, but their share of accidents, fatalities and dollar losses have only gone up one-third. Therefore, our equipment was being managed with a reasonable amount of efficiency from 1950 to 1955, but it is no time to be complacent because the new equipment is absolutely unforgiving.

We have identified jet fighters and jet trainers as the biggest problem area. Now, we have to see who is busily engaged in cracking up this stuff, and we find that pilot error accounts for some forty-six percent of our accidents; maintenance error, supervisory error, and some of the others run this tally up to about sixty-two percent.

This talk about jet fighters and jet trainers is particularly important because we can reduce this specifically to terms of combat potential. If we use the same ratios that we had in Korea, the jets we lost last year could have shot down in war over 6,000 enemy aircraft. As an ex-SAC aircraft driver, it would tickle me to death to know that I have 6,000 fewer interceptors to worry about. This is a combat potential of no mean proportions. This is how accidents drain the combat potential of the Air Force.

(Continued on following page)



Gen. Curtis E. LeMay, Commander-in-Chief of the Strategic Air Command, looks at chart illustrating the decline in total accidents (major and minor) within SAC. For the AF as a whole, fatal aircraft accidents per 100,000 hours are down to four—an all-time low.

What is the impact on civilians? We are running a study on how many aircraft accidents involving civilians concern houses that were there before the airdrome was put in or which were built after the airdrome was put in. This is important. Many people beat the drum about airdrome nuisances. Yet, as you heard yesterday, it is almost impossible to keep them away from the airdrome. This, I think, is information we should develop. It has to be hand-screened and it takes a little time. I do not know if you realize it or not, but over sixty-one percent of our accidents occur on airbases, which automatically eliminates any involvement with civilians.

Another sizable percentage, some seven or nine, occur in isolated areas—over the ocean, out over the desert, maybe in the Arctic. So, a sizable segment of our aircraft accidents cannot have any bearing on civilian property or life.

In line with this, I will be the first to admit that in 1954 there were some thirty civilian fatalities from accidents involving Air Force aircraft, and the dollar loss in civilian property ran to about $500,000. This is a sizable sum, and yet it is less than two percent of the cost to the Air Force for accidents affecting only Air Force aircraft and people —less than two percent. I think this is important.

I'd like to read some figures. Last year, there were 90,000 fatalities, 9,000,000 injuries, $9,800,000,000 in civilian property lost or damaged from accidents *other than air*. Vehicles last year killed 7,900 civilians. These are not the knuckleheads who are driving the cars! These are the poor unsuspecting men and women on the sidewalks. They killed 7,900 people and damaged property at the rate of $1,600,000,000.

In the course of a year, Air Force property damage amounts to some $500,000.

Some time ago, I was flying across Nevada, heading northeast, when I got a radio message: "Don't go there. Go down to Charleston, S. C. There has been an accident." I went down. We landed for fuel at Tinker AFB, Okla., and the headlines were already in the papers. When I got back to the West Coast, the headlines were in the papers out there. They were about two civilians, killed in this particular accident.

Three weeks ago in Colton, Calif., a tractor-trailer jumped the curb, went through a building and killed five people—wiped out a family. I was right behind it. I saw it happen. It made a little headline, one column wide in a local paper. Nobody heard of it across the country.

BRIG. GEN. JOSEPH D. CALDARA, *USAF Director of Flight Safety Research, was born in Fairmont, W. Va., in 1909 and went to school in Buffalo, N.Y., and the University of Maryland. He was commissioned in the Air Reserve in 1932, and after two years as a pilot returned to civilian life. Recalled in 1941, he has seen continuous service since. He served in various operations and plans positions, both in the US and overseas during World War II, and later served as Chief of Staff, Alaskan Air Command, and as Commander of the 21st Air Division, SAC.*

Automobiles and trucks kill 7,900 people at a cost of $1,600,000,000, and no one is running around beating the drum, saying, "Let's get the automobiles and trucks off the highway." Flying is a mode of transportation, whether it be combat or civilian flying, and it has to be regarded as such.

For five years, the Director of Flight Safety Research has been conducting some aggressive programs, not only in accident investigation but in accident prevention. Right now, ninety percent of our effort is on accident prevention. We have decided, after an analysis of the areas of accidents, that there are three things we should do. This is a continuing program. There is nothing new about this. We have concentrated our efforts in three areas of education: one, to educate the aircraft manufacturers; two, to educate the Air Force commanders at all levels; and, three, to educate the aircraft operators.

I want to give you some specific examples. First, we are conducting a series of meetings with the manufacturers that have to do with design safety. A careful analysis last summer indicated that every now and then we put a pilot in a position where he had to buy the farm. He had no other choice. We have identified these areas. We do not call these pilot areas any more. These are design-induced accidents and, believe me, we have them.

The reception on the part of industry has been phenomenal. I am astounded. We have talked to as few as fifty and as many as 500 engineers in a given day. We have talked to two and three plants in one day, and these people want to know how they can help.

No design engineer deliberately contrives an accident-

inducing feature in an aircraft. We know it. All we are doing is pointing these things out. This is one way we educate manufacturers.

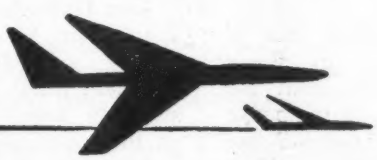
How do we educate commanders? This is predicated on the fact that we in the Air Force can never be satisfied with a given level of efficiency. We must always try to improve it. There are a couple of specific things that we do to assist commanders, whether it be at major command level or numbered Air Force levels or down at wing levels. One of these is called an operational safety survey team. This operates out of our office on the West Coast. It is composed of a project officer on the aircraft; operations people; facilities people; medical safety people. They go on a base and take a good look at its operation. Then they come up with certain specific recommendations. We can and do forecast accident areas on a base when we have completed such a survey. This is not one of these reply-by-endorsement deals where the poor commander gets heckled. We talk to all of his people while we are conducting this survey, and we approach it from an operational viewpoint.

How do we help aircraft operators? And when I say aircraft operators, I mean the pilots. I am not talking now about the pilots with 5,000, 6,000 and 10,000 hours. I am talking about the bright young second lieutenant. He only knows one word—tiger—and I am telling you that I am firmly convinced that we have more tigers than we have smart tigers. Our job is to get more smart tigers. This can be done.

To do it we have what we call a transition indoctrination team. Maybe an outfit is getting new type aircraft, or it may be a National Guard outfit getting aircraft that has been in the inventory for a long time which they have never flown. We take a man who can fly the aircraft. We take a civilian test pilot from the manufacturer. (You would be surprised at the number of airmen that went into a flat spin because we were taking civilian test pilots.) We do this because we want the civilian pilot's point of view as he has watched the aircraft develop. We talk about the bugs, and we get the bugs out of it. This is how we are trying to educate the operator. We spend as much as ten days on the line if it is necessary, dealing with the man who is driving the equipment. We take in all of the areas and we fly with these people. These are just single examples. We have nineteen programs going. We have the most wonderful command support I have ever witnessed in any operation in the Air Force. It starts with General Twining and General White, and it goes down to every commander I know.

Now we come to the question of noise abatement, and the problem of what kind of tailpipe we are going to have on these hot pipes. This a long-range deal, and so are some of these accident prevention things. I do not believe there is such a thing as an irreducible number of aircraft accidents. That would be zero. People think the rate of 17.2 is good. I do, too. I think we can have it this year, and if we have it this year, that means that we will only have fifteen civilians involved in fatalities and $250,000 involved in property damage and that much less flak from the civilians. There is one thing we have to do in the Air Force, and that is cut the mustard operationally. That is all we are trying to do. If we do this by keeping the civilians off our backs, we can do a better job, not only for us but for you who are interested in the Air Force and for all of the civilians who complain about aircraft accidents.—END

the jet age



The Role of Civilian Airports

Robert Aldrich
PRESIDENT, AIRPORT OPERATORS COUNCIL

IT IS gatherings like this—the bringing together of the outstanding leaders in the aviation world—that will lead to the solution of the many problems which we all know confront us, *and which confront us all!* Military and civil aviation groups have their mutual problems; and, within civil aviation, the manufacturers, the aircraft operators, and the airport operators have their common problems—which, if they are to be solved at all, *must be solved jointly and on a mutually acceptable basis.*

Recently, an airline president was reported to have said: "We are buying airplanes that haven't yet been fully designed with millions of dollars we don't have, and we're going to operate them off airports that are too small in an air traffic control system that is too slow, and we must fill them with more passengers than we've ever carried before!"

This was said in an atmosphere of joviality, no doubt, but the recognition of the basic problems is clearly evident.

The rewards for joint solution to these problems will mean real progress in the development of civil aviation and real security to the nation.

The penalties for failure to solve them jointly will mean:

- Weakened national defense;
- Poor air transport service to the public;
- Financial losses to the stockholders;
- Excessive taxes to all of us.

The underlying principle I want to emphasize is the complete interdependence of the airframe and engine manufacturers, the aircraft operators, and the airport operators in the development of jet transport service. We each have a quasi-monopoly in our respective fields—

(Continued on following page)

not in the anti-trust sense, but in the practical sense.

The manufacturers of engines and airframes of the large jet transport type are a superb group—but you can count the principal ones on one hand.

The airlines which plan to use the large jet transport aircraft are real leaders in the field—but they can be counted on two hands, because few carriers have either the route system or the financial resources to own and operate such aircraft.

The airports serving the major traffic-generating communities are relatively few in number, and, if these airports cannot accept the jets because of noise or operating characteristics, then the jets will not be useful to the air commerce of the nation.

The usefulness of the jet, or any other vehicle for mass transportation, is measured by the universality of its acceptance at major traffic generating centers, present and future.

ROBERT ALDRICH *is president of the Airport Operators Council and executive director of the Minneapolis-St. Paul Metropolitan Airports Committee. He was born in New York, N.Y., in February 1896, and was educated at Rensselaer Polytechnic Institute. From 1927 to 1930 he was president and general manager of Flyers, Inc., Syracuse and Albany, N.Y., airports. Until 1943 when he assumed his present position, he was with the Empire State Radio Laboratories, Albany, N.Y., and then with American Airlines. Mr. Aldrich now makes his home in Minneapolis.*

Even with this strength of position each group holds, we cannot stand alone—nor do we want to! We must be partners in the fullest sense.

No longer are we the adventurous, carefree kids of yesteryear, building airplanes with bailing wire, flying off sod strips—with our most sensitive instrument the seat of our pants. No longer can we afford to scrap like kids over real or imagined differences of opinion like we did when the aviation industry was growing up. We must all give evidence of having matured with it.

Today, airports alone represent an investment by the public of nearly $3 billion. The airline stockholders probably had a billion dollars invested in flight equipment prior to the recent jet orders, which may double that. And the manufacturers' investment is comparable in magnitude. We are, indeed, partners in big business.

Together, therefore, we are the trustees of billions and billions of dollars, and, more important, we are also the guardians of millions and millions of lives.

These billions of dollars in investments which we supervise are those of the citizens of this nation, who own the stock that makes it possible to build the aircraft; who buy the tickets to ride the planes that keep the airlines in business; and who pay the taxes to make possible the building of the airports from which to take off and land.

The lives entrusted to our care are these same taxpayers, ticket-buyers and stockholders—millions of them!

We realize that in the great free-enterprise system in which we live, the seller and the buyer, the manufacturer and the aircraft operator, will haggle and bargain to a mutually agreeable compromise.

We realize also that the landlord and the tenant—the airport management and the airport user—will have some differences of opinion as to how much rent to pay.

But, in the heat of these skirmishes, let us never lose sight of the goal we all seek—better air transportation for the public plus better economic health and national security for us all.

We will get better air transportation if together we face up to and solve such urgent problems as:

- Joint military and civil use of major civil airports;
- Terminal area traffic control;
- Community relations including the very real social problem engendered by aircraft noise;
- Physical, political, and financial obstacles to ever-increasing expansion of ground facilities;
- Terminal building design and facilities requirements for jet operations;
- Take-off, landing, taxiing, and service area requirements for jet operations; and
- Passenger, spectator, and employee protection.

These are just a few of the many areas of mutual problems to which joint solutions must and will be found to assure continued progress in the Jet Age.

Our economic health will be assured if we mutually recognize that: (1) the manufacturer must get a fair price for his product to stay in business; (2) the air carrier must make a fair return or go on subsidy, and (3) the airport must have revenues commensurate with costs or become an intolerable burden on the taxpayers.

We sincerely and earnestly urge that the leaders of aviation represented here—the best brains of America's most dynamic industry—pause long enough in this history-making and extraordinary age in which we live to recognize the basic truth that the manufacturer, the aircraft operator, and the airport operator must depend upon each other for their very existence, and, like love and marriage, "You can't have one without the other!"

• • •

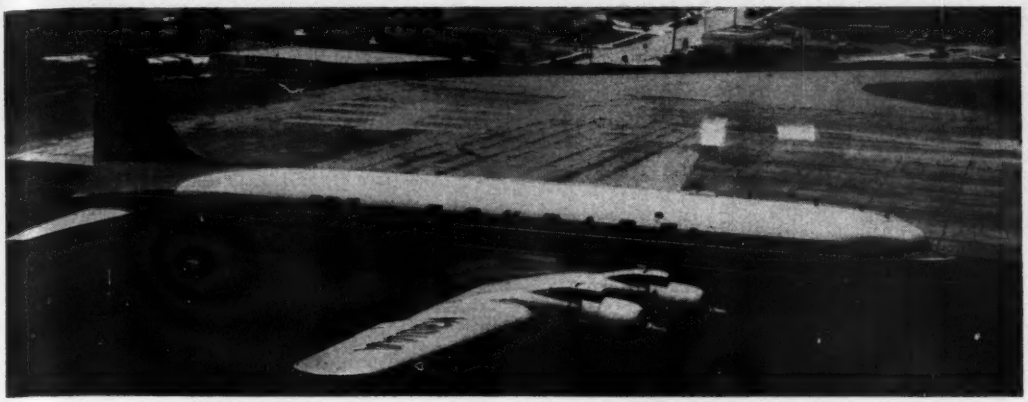
Jean DuBuque [National Business Aircraft Association]: I am going to ask the $100,000 question. Where is the money coming from in the communities that do not have sufficient funds to extend their runways, buy additional property, improve their terminal buildings and take care of their zoning problems?

Mr. Aldrich: That sounds peculiarly like the questions we are asking. I think you and I both woke up at about the same time this morning. We do not know the answer. We just know this: it "ain't" going to be done without the money. [Applause]

General Doolittle: Are there any further questions? If not, I will dare ask one myself. You spoke of improvements at the airports. You did not speak specifically of runway length. I would like to ask in the age of jet transports are such modern airports as Idlewild, Los Angeles, San Francisco, and O'Hare at Chicago adequate in runway length for the anticipated jet transports?

Mr. Aldrich: Ladies and gentlemen, you have just heard one of our most extremely competent aeronautical engineers ask a question like that. Jim, I am not going to ask you the question as I turned it back on Jean. We did not mention it specifically because in runway language and jet aircraft performance this is the great day of unspecifics, or non-specifics. Boeing Aircraft has proved that a jet transport will fly; a lot of other stuff is on paper and in people's minds. Our presentation here referred to runways quite generally because they are a major item, but it is also a question which is involved with a lot of other things on the physical side of the airport.

With the best information that we have at hand today and with what we know about our own airports as to



The nation must solve urgent problems such as the very real social problem of aircraft noise. Here, a Douglas DC-7 warms up within earshot of a community on the very edge of the runway.

runway lengths, and speaking very generally about the type of jet aircraft, we are under the impression at the moment that we have no airports in the United States with the exception of Honolulu on which, generally speaking, the jet type of transport can be operated; that is, as to runway.

As to runway strength, which is a new item—not for the airport operator but for the people who are interested in what it costs to break up these runways at an accelerated rate—we are learning a great deal and we find now we are becoming extremely concerned with the maximum strength designed factors of runways, particularly as to runway thickness, because lengthening the runway is one thing but replacing it every five or ten or fifteen years is a totally different thing.

Floyd Ricard [Economic Division, Air Coordinating Committee]: In connection with the problem of the joint military-civil use of airports, I would like to ask Mr. Aldrich if he considers that these problems are getting more complex as individual problems arise. Do you feel that the Airport Use Panel is the proper instrument with which to deal with this problem at the Air Coordinating Committee level of the government, or do you believe that something else should be devised to do the job?

Mr. Aldrich: Floyd, I do not think that I could give you a complete answer and a hopeful one on that until I understood all of the operations and all of the machinations of all of the Joint Airport Use Panel, which I do not. I am sorry that that is not a very helpful answer, but it has to be limited by my own limitations.

Mr. Ricard: I brought the matter up because it is one of the means that you have for settling disputes between the military and civil where these joint problems arise. While we have not had any controversy which had to go up to the presidential level, we do have the one notable example of O'Hare in Chicago. There may be others as the need for joint use increases. The joint problem that went on upstairs at O'Hare was not settled, was it?

Mr. Aldrich: I am not sure. If the Joint Airport Use Panel can give some programs for the settlement of the types of problems that I have enumerated here, particularly from the joint use standpoint, I'm encouraged.

Jean DuBuque [National Business Aircraft Association]: Our Association is an industry member of this Airport Use Panel, and if I may, I would like to help answer the question. We feel that this is a sounding board because the military, industry, and other civil-government agencies are represented and are given an opportunity to air all of the problems involved in joint use of airports. I have attended a number of hearings as an industry representative, and they have all been fair, impartial, and have taken the problem into full consideration. I believe it is an excellent body to continue studying joint use.

Dr. T. P. Wright [President, Cornell Aeronautical Laboratory, Inc.]: The question you raised was an extremely good one since it had to do with runway length. Would it not be possible to look at these problems from the airport standpoint in having the design of our Jet Age aircraft of the steep gradiant type; if that is practicable? In other words, if the aircraft can be made to take off more steeply and can land in a shorter distance, it would help solve some of our problems in all three of these areas—in the area of noise, where it would get the source of the noise away from the people more quickly, and it would insure that the aircraft would fly over areas of population at low altitudes for a lesser distance.

From the standpoint of runway length, it is obvious. From the standpoint of getting the aircraft away from the low-altitude flying over centers of population, I think it would create better public relations. I feel that this is practicable now and that greater attention to boundary layer control which could be applied to aircraft already in the mock-up stage—such as the DC-8 and the 707 and the Electra—might lead to something that would help solve many of the problems that have been brought up.

I would be very much interested in your reaction, Mr. Aldrich, on this. If we could get really steep gradiant aircraft, it would be a partial solution at least to almost all of the problems that are being raised here.

General Doolittle: Ted, I am not supposed to do any work here. I am merely supposed to point at people and they do the work, but I would like to carry that point on a little further.

There is a great deal of thought being given at the present time to short take-off and landing runs. There is a great deal of thought that we cannot go to longer runways. That is due to the concentration of population in the metropolitan areas. Due to the fact that no matter how long you make an airfield, it will be surrounded and hemmed in, possibly we have come to the point now where we should devote more of our thought to improving aircraft performance rather than solving the aircraft manufacturers' problems by lengthening the runway. That is the reason I brought up that question. I was a little shocked when Mr. Aldrich said "We ain't got no airports for the future." That left me a little startled. If Idlewild Airport is not long enough, I do not know where you can get a longer airfield.

We took a look at Long Island and there is no place on Long Island where you can put a modern airfield today without having to tear down some existing structures. This is a real serious problem.—END

the jet age

Civilian Aeronautics in the Jet Age

Charles J. Lowen, Jr.
ADMINISTRATOR, CIVIL AERONAUTICS ADMINISTRATION

THREE weeks ago the Civil Aeronautics Administration held an all-day meeting in Washington on the Jet Age, with particular emphasis on what it would mean in terms of airport requirements. I think the CAA and all who participated in that meeting learned a lot from it, and the only criticism I have heard of it was that we held it too far ahead of time.

This is a criticism I hope to get more often as Administrator of Civil Aeronautics. I would much rather be criticized for being too far ahead than for being too far behind.

The same statements apply to this much broader conference, and I am sure that it will prove equally helpful to explore these problems together, even if we don't come up with answers to all of them.

Since other speakers will discuss other aspects of the Jet Age, I will concentrate on . . . airports. As we found out at our January 11 meeting, however, you can't get far into airport questions without considering such related matters as the characteristics of the aircraft that will use them, including their noise level, fuel consumption, and so on. To some extent, therefore, I will have to overlap other subject areas on the agenda.

Let me further preface my remarks by saying that none of my statements are offered as final, definitive solutions. We hope that as a result of meetings like this, and of continued specific research and experience, it will be possible to arrive at firm criteria, by which all segments of the industry can be guided.

With civil jets due to go into service by 1958 or 1959, we cannot wait too long for these answers, but on the other hand we cannot afford to freeze standards on the basis of incomplete information.

There's no such thing as a jet airport, period; there can be airports for jets flying non-stop between continents, and there can be airports for jets flying 600-mile hops, which at present appear to be the lower limit of their efficient range.

The requirements for an intercontinental jet airport may be twice as great, in terms of runway length, as for a trunkline jet stop. At our meeting we heard tentative figures of 9,000 to 9,500 feet take-off run for the 4,000-mile jet flights, and as little as 4,500 feet for the 600-mile range. These are for sea level and standard temperature of fifty-nine degrees. Our present standards call for increasing the length seven percent for each 1,000 feet of elevation, and it appears that this ratio will continue valid. Right now, we correct the length upward by one-half of one percent for each degree that the mean temperature of the hottest month of the year exceeds fifty-nine. It is likely that the temperature factor for jets will be about this much, but it remains to be established precisely.

Let's see what this would mean in readiness for jet operations of some typical large airports today. The longest runway at New York's Idlewild is 9,422 feet, but when corrected for altitude and especially for temperature, its effective length is 8,724. At Chicago O'Hare the comparable figures are 8,000 feet, corrected to 6,838. Boston has 10,012 feet, the equivalent of 9,185 when corrected. Los Angeles's 8,561 feet corrects to 7,317, but at cooler San Francisco the 8,870 feet of runway adjust to an effective 8,612.

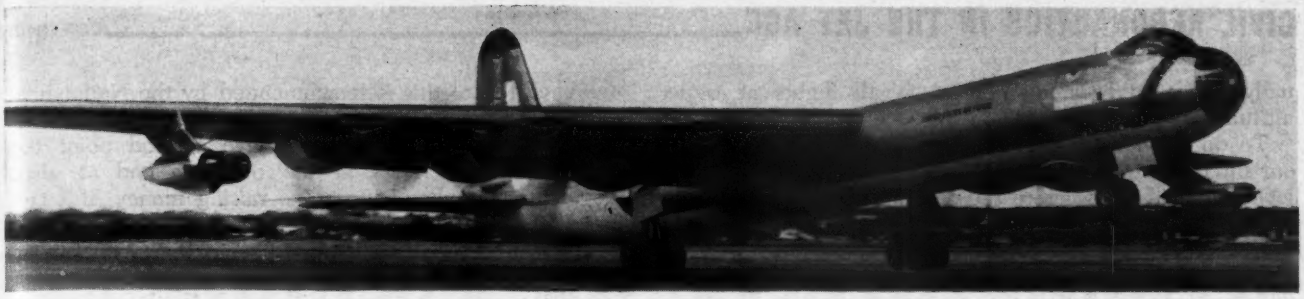
It seems fairly clear, then, that while our major airports will be able to handle domestic jet operations, they may run into trouble when it comes to intercontinental flights. In view of this, we are urgently reviewing our present standards under which we grant federal aid to projects for development of intercontinental express airports with runway length up to 8,400 feet (prior to adjustment for altitude and temperature).

In case anyone has forgotten, however, our federal aid program is a matching one, in which the local government pays at least fifty percent of the cost. Representatives of local government present at our conference expressed themselves rather strongly about the difficulty of getting taxpayers to back investment in additional runways at the rate of about $1,000 a foot. They pointed out that cities are under heavy pressure to improve schools and roads, and that airports are therefore in sharp competition for funds.

Against this argument can be balanced the view that it is the residents of our cities who are the users of air

---

CHARLES J. LOWEN, JR., *Civil Aeronautics Administrator and a pilot with seventeen years in aviation, was born in Denver on June 15, 1915. After he was graduated from the University of Colorado in 1938 he became a partner in Mountain States Aviation, a five-state distributorship for various aircraft manufacturers. During World War II he served with the Air Transport Command as a pilot and in command positions. He joined CAA in May 1955 as a consultant, became Deputy Administrator in July, and succeeded Frederick B. Lee as Administrator last December 9.*



Jet transports will likely use landing gear like that on the B-36 to distribute weight better on existing runways.

transportation. They will profit by the introduction of jet aircraft, which will cut their travel time almost in half. Furthermore, the speed, plus larger seating capacity of jet transports now under development, may be the key to lower-cost air travel, and thus vastly widen the group of people who can benefit by it.

This is not a problem that the federal government can settle by dictatorial fiat. Each city will have to weigh how much turbine transportation is worth to it in dollars and cents. Each manufacturer will have to determine how far he can go in tailoring his design to existing facilities without sacrificing its basic efficiency. Each airline purchaser of jets will have to calculate how much gross income they may earn, and how much of this may go in charges for use of improved facilities.

As for the CAA, our legislative mandate is to foster the development of civil aeronautics and of a national airport system adequate to anticipate and meet the needs of civil aeronautics. When cities come to us with project requests for federal aid, we will look favorable upon any which can be shown to fit in this framework of a national system.

So far I have talked only of runway length. This is a key question, but only one of dozens of aspects of an airport that must be considered in accommodating the Jet Age. What about the width of runways? Today we call for 200 feet for our two largest categories of airports. Here, many people will be pleasantly surprised to learn, we find it possible to consider very seriously a proposal of the Airport Operators Council that the standard be reduced to 150 feet.

The jet transports now planned have wing span not significantly larger than today's aircraft, and we may be able to offset some of the cost of additional runway length by reducing the width.

Optimism also seems indicated on the runway bearing strength required by jets. Here again we are not dealing with absolutes. It does not mean anything in terms of runway requirements to say that a jet transport weighs 280,000 pounds. What is important is how that load will be distributed. The manufacturers of jet transports plan to use dual tandem landing gear. The significance of this can be measured by an example: Idlewild Airport will support a single-gear aircraft with gross load of 200,000 pounds, but it will take a dual tandem gear aircraft weighing 500,000 pounds. On this basis, many of our large airports already have adequate bearing strength, and where beefing up is needed, it is possible to install an overlay that is less expensive than constructing new runways.

We did get an indication, however, that it may be necessary to provide additional strength for certain portions of the runway. For example, at the point where air brakes are applied and the load is transferred from the wing to the wheel brakes, and thereby to the pavement.

Additional information also is needed as to the effects on pavement of *spillage* of jet fuel—blast and heat are not expected to be serious considerations except possibly where the aircraft stands still. The manufacturers have indicated that jet transports can be taxied at twenty-five percent thrust, so that the blast effect would not be significantly more than from a propeller-driven airplane.

Fueling is an important item. A single flight, depending on its length, may require anywhere from 6,000 to 18,000 gallons of fuel. It is obvious that with such quantities involved, the type of fuel must be standardized for it would be a staggering job to provide separate storage capacity for several types.

Our conference was told that standardization studies have been going on for a year and a half. I am sure those participating realize the importance of reaching a solution in the near future.

There will be many problems associated with the terminal buildings, created in most cases not by the jets as jets, but simply by the fact that they are planes of larger capacity than the buildings handle today. To highlight this area, I need only ask, "Do you know any airport in the United States that has ticket counter space for 150 or 160 passengers boarding the same flight?"

Now, I have said that I would concentrate on airport requirements for the Jet Age, but it is impossible to ignore the fact that the special characteristics of the jet plane are most apparent when it is in the air. We in CAA have the responsibility not only of helping to develop the facilities for planes to take off and land, but even more important, of providing safe separation while they are in the air.

For this reason, I would like to tell you a little about what we hope to do toward increasing the capabilities of our traffic control system. The one feature, other than speed, that most sharply distinguishes the jet transport from current civil aircraft is that this new beast is an inhabitant of the higher altitudes. It operates most efficiently at about 30,000 to 40,000 feet. When a B-47 makes a missed approach, for example, I understand it consumes some 2,700 pounds of fuel just in descending from and returning to the 1,000-foot level.

While we expect the fuel consumption of civil jet transports to be better, it is clear that we will have to be able, first, to provide traffic control that keeps these fast-moving planes under surveillance while they are en route in the upper airspace, and second, to bring them down promptly when they reach their destination.

The President's budget message called for $40,000,000 to install new air navigation facilities. A primary purpose of these facilities would be to begin controlling all airspace above 24,000 feet. In other words, we would move our traffic control into the Jet Age immediately. The military are operating jets in the high altitudes right now, and want such service. We propose to give it to them, and by so doing, to perfect our methods for the day when civil jets will add their numbers to the upper strata traffic.

Initially, control of the air above 24,000 feet would be provided for flights under instrument rules only. Event-

(Continued on following page)

ually, we would extend control to all flights at those altitudes.

To do this job next fiscal year, we will have to extend our direct controller-to-pilot communications facilities, for jet speed will not tolerate the delays involved in relaying information. We will need to improve the equipment in our centers for displaying traffic data. And the President's budget also calls for additional long-range radar, with which we can at least bracket the congested area bounded by Boston, Norfolk, and Chicago.

The program set forth in the 1957 budget is only a beginning. We have drawn up a five-year plan for the orderly development of the air navigation and traffic control facilities necessary to keep abreast of our skyrocketing aviation growth.

This plan has been coordinated fully with all elements of military and civil aviation, as represented in the Air Coordinating Committee. It has been submitted to the Congressional Appropriations Committee and will be released when they are satisfied that it is appropriate to do so. Therefore, I will not discuss this matter in detail at this time.

We know that in addition to installing better physical equipment, it is equally vital to upgrade the knowledge and skills of the people who will operate the equipment. Through the courtesy of the Air Force, a number of CAA people have been given the opportunity of attending jet indoctrination school. We hope to be able to carry this training process a step further, and arrange to send a group through a course in B-47 operation. I have still other programs in mind that will equip our traffic controllers to do an even better job with jets than they have done with piston-engine planes—and I think it should be acknowledged that they have done a marvelous job of stretching the capacity of outmoded control facilities to handle an ever-increasing load.

• • •

Maj. Gen. Junius Jones [New Orleans Airport Commission]: I would like, if it would be feasible, to have an airport use committee which would recommend the length and strength of runways and other appropriate details for the asistance of the local planners. It would be a whole lot easier if we could go to the city council and the people who put up the money and say, "This is what we have to do; this is recommended by the National Airport Use Panel."

Mr. Lowen: I believe you have a good point there because, having been in the domestic end of airport development, when it came to raising money, if I could have had such a group to back me up, I think it would have been a substantial assistance to me. We are going to work with a committee. We have had many people volunteer their services to help us in these problems, and I think that we can take advantage of their suggestions. Your point is well taken. It is one which we will certainly consider.

Dr. T. P. Wright [President, Cornell Aeronautical Laboratory, Inc.]: The question I have to ask stems from a comment Mr. Boggess made yesterday, which had to do with the failure of the airlines to utilize the already installed VOR/DME system. Do you not feel that during the time when your five-year plan is being consummated and during the time when TACAN is being perfected, it would be in the general interest for the airlines to equip themselves with VOR/DME systems?

Mr. Lowen: Mr. Wright, you know right where to put it. I think that any navigational aid that would help should be used. Right now, we are wrestling with this problem, so I can understand the problems of the airlines, the industries, and the military. But I am in no position at the moment to come up with any conclusion. I hope to in the very near future. [Applause]

From the floor: Have you ever explored the possibility of water for taking off and landing seaplanes?

Mr. Lowen: We have one gentleman by the name of Joseph Blatt who is in our planning department of the CAA who has his own special project and theory on water, and he feels that ultimately this has a tremendous amount of merit. I have not talked to him about it in detail, but he said that some day he wants to discuss water air strips or airports in more detail. I think it does have merit.

Jean DuBuque [National Business Aircraft Association]: Are there any plans afoot to indoctrinate CAA personnel with the Air Force on the use of jet transport aircraft so that they will know in advance some of the problems?

Mr. Lowen: We are just about to go to bed with the Air Force on that, yes.—END

New GE radar at CAA Air Route Traffic Control Center, New York International Airport, controls aircraft within a 100-mile radius. Air traffic control is one of the most serious problems facing CAA in the Jet Age. Besides installing better physical equipment, CAA plans training programs for its traffic controllers to equip them for Jet Age traffic.

the jet age

Military Air Traffic Control

Maj. Gen. Kenneth P. Bergquist
DIRECTOR OF OPERATIONS, USAF

THE INCREASING congestion of the airspace over the whole United States has become a matter of primary concern to all of us. The cause of this congestion has been well established and is threefold: (1) the greatly expanded volume of air traffic, both civil and military; (2) the sharply increased operating speeds and other critical performance characteristics of jet aircraft; and (3) the fact that our air traffic control system has not been able to keep pace with these expanded requirements placed on it.

The basic problem—that of increasing the *capacity* of the air traffic control system—has received extensive study in the last few years by many groups and special committees, both in and out of government. There are many technical developments being studied and evaluated by the Air Force, Navy, Civil Aviation, and CAA which are directed toward improving air traffic control.

Mr. Lowen has discussed some of CAA's requirements for the years ahead and the CAA five-year-plan for improving the capacity of the Federal Airways System [see page 80]. The Air Force, through its membership on the the Air Coordinating Committee and daily working relationships with CAA, has supported and endorsed the CAA plan during its development. It is a positive step in the right direction and is long overdue. And we sincerely hope that they don't fall off that "tiger."

Now, let's focus on our objective. We have all recognized the requirement for a Common Civil-Military System. In 1954 the President's Civil Air Policy Committee reported in part as follows:

"It shall be the continuing policy of the United States to:

"1. Provide for a single national common civil-military system of air navigation and air traffic control.

"2. The common system shall be capable of immediate integration with the air defense system of the United States and will constitute an auxiliary to the air defense network.

"3. To provide for an accelerated joint civil-military program of research and development to bring and keep the system abreast of current and foreseeable future operational requirements.

"4. To accelerate the transition to the most advanced concept of this common system."

We must keep this policy in focus constantly. It is often easy to become sidetracked.

Now I would like to cover four major points with you in this order:

- General military requirements;
- The effect of congestion on the Air Force mission;
- The relationship between air defense and air traffic control;
- A future concept.

Military requirements having air traffic control implications can be stated simply and briefly. The vital nature of the Air Force mission to the security of this country makes it necessary that the Air Force be able to:

(1) Operate with as few restrictions as possible;

(2) Employ our weapons to the maximum of their designed capability; and

(3) Operate safely under all weather conditions.

Fighter-interceptor units and their augmentation forces must be able to scramble instantly and by the most direct routes to their targets. Every minute and every pound of fuel count. SAC strike forces and their support refueling units must be able to take off from their bases without delay. Tactical Air Command must be able to deploy its forces on a moment's notice. Support airlift for SAC, TAC, and for the Army must be able to move and deploy rapidly. Speed and flexibility are essential.

As you well realize, the ability to accomplish this mission in time of emergency involves extensive, continuous, and realistic training to meet the high state of readiness required. Our combat force will soon be one hundred percent jet-equipped, and supersonic aircraft are with us in numbers. These are our weapons, and we must be able to employ them efficiently.

Air traffic control has been defined as a *service* designed to promote the *safe, orderly,* and *expeditious* movement of aircraft. The record shows unquestionably that safety in the present air traffic control system has obtained a high degree of success. However, the success in safety has been bought through sacrifices in flexibility and capacity of operation. Fast movement of air traffic is far from reality.

The drastic differentials of jet and conventional aircraft performance in rates of climb, rates of descent, high cruising speeds, and high operating altitudes have outstripped traffic control capabilities. Jet flying characteristics of short endurance and high fuel consumption require the establishment of unique climb and let-down procedures.

To increase the capacity of the system, it is basically necessary to reduce the spacing between aircraft now required to insure safe standards of operation. A simple example: Existing separation standards under poor weather conditions require ten-minute separation between aircraft of similar type on the same route at the same altitude. For a DC-3 aircraft, this distance is approximately thirty miles. The same separation standard, when applied to aircraft operating at 600 miles per hour, would require *100 miles separation.* At higher altitudes, separation standards are increased even more due to higher speeds and reduced navigational accuracy. As a result, when higher performance aircraft are operating in the system, less traffic can be handled.

(Continued on following page)

The complexity of the control problem is not only increased by higher performance aircraft, it is also affected by steadily increasing areas of high-density traffic. Therefore, we in the Air Force find ourselves facing many new terminal traffic control problems where they have not existed heretofore. This is especially true of some of our Reserve, Air National Guard, and Air Defense units, which, by nature of their missions, must be located near large population centers.

Specifically, how is the Air Force being directly affected:

- Because the coordination system of air traffic control now in use by controllers and the associated communications which he uses are too slow, jet aircraft have actually arrived at points along their flight path in advance of information concerning their flights. The results are compounded delays for our own and other aircraft operating in that particular part of the system.
- Large groups of aircraft scheduled to depart on specific missions on precoordinated clearances have been delayed excessively in spite of this precoordination.
- Many air route traffic control centers have not been able to accept IFR clearances for excessive periods of time, resulting in delays to Air Force aircraft and, in some cases, cancellation of missions.
- Because the system does not have sufficient capacity, our air bases located in high density areas must use extremely complicated procedures for arrivals and departures.

All in all, the delays which are being experienced by the Air Force subtract from essential training time and could be calculated in terms of millions of dollars annually—costs which the taxpayer must meet and which would put many commercial operators out of business. We recognize that Air Force operations pose a terrific air traffic control problem; but in the interest of national security, we cannot continue to accept delays to our operation.

MAJ. GEN. KENNETH P. BERGQUIST, *Director of Operations, DCS/O, Hq., USAF, was born in Crookston, Minn., on November 21, 1912, and attended school in North Dakota. He was graduated from the US Military Academy in 1935 and the following year completed Advanced Flying School and transferred to the Air Corps. During World War II he served in both the South Pacific and the ETO. General Bergquist is a senior pilot.*

As indicated, the President's Civil Air Policy Committee recognized the interrelationship of air defense and air traffic control. Although air defense and air traffic control have different missions, the successful accomplishment of both missions is dependent on the ready availability of identical information—*namely*, aircraft detection, position, and identification. Both control take-off time, route, altitude, and recovery.

We can see then that air defense and air traffic control not only require the identical information, but in some circumstances their functions overlap. To prevent duplication of effort, unnecessary expense, and to permit maximum exchange of information, these systems should be made compatible.

When air defense was first established, manual methods were employed. It became apparent that the rapid development of aircraft and missiles, both in numbers and performance, required that the entire operation be highly automatic, from the location and identification of an enemy plane to the coded radio transmission which directs the automatic pilot of our fighter or missile on an interception course.

You have all heard recently about the development of SAGE (Semi-Automatic Ground Environment). SAGE is that portion of the air defense system that provides the *means* for the semi-automatic processing of data and weapon control. Information received is processed and displayed pictorially to show all aircraft operating over an extensive region. In other words, it shows the whole "air situation." Then the electronic brain takes over and solves the intercept problem and issues guidance instructions to interceptor aircraft and missiles.

Dr. Valley will give a much more detailed explanation of SAGE [see page 111]. But, I want to make this point—most of the information which is displayed in the "air situation" would be extremely valuable for air traffic control purposes. However, the SAGE computer is programmed or set up to solve the air defense problem.

Yet this same type of computer, if set up to solve the air traffic control problem, could certainly supply the rapid problem solving required in complex air traffic control situations.

As with air defense, the complexity of the air traffic control problem has surpassed human capabilities even when utilizing the best equipment we have today. Like air defense, air traffic control must look to automation for the solution to its problems. In so doing, and this is a very important point, the system that is developed must be *compatible* with the air defense system. There will always be a need for a close exchange of information between the two functions.

Several months ago, the Air Coordinating Committee recommended that the agencies concerned study the potential of the SAGE computer for air traffic control purposes. A project was initiated in the Boston area under the sponsorship of the Air Navigation Development Board. We must get on with this project as soon as possible.

I would like to mention briefly the application of air defense radar to Common System air traffic control as has been recommended for a number of years. Many of these defense radars are located in or near areas of congested air traffic. In coordinated actions with the CAA, Air Defense Command radars in many areas are presently performing an extremely valuable Common System service by providing departure and approach guidance and by assisting pilots in avoiding adverse weather conditions. The CAA and the USAF are now conducting joint evaluations and experiments with the object of further use of air defense radars. From the standpoint of economics alone, it is highly desirable that information from these radars be used to serve the dual purpose of air defense and Common System air traffic control.

The Air Force feels strongly that the objective at this time should be to obtain the best possible combination of air defense and air traffic control elements, while at the same time recognizing the needs of the individually distinct missions of each.

May I emphasize that we have always worked closely with CAA. In the past we have made available to them military radars for use in the New York, Chicago, and Washington areas. Recently, we have made a long-term loan of a modern air defense radar, to be used by CAA to assist in air traffic control in the New York area. The CAA is currently using Air Force-provided radar approach control units (RAPCONS) and plans to operate additional Air Force-provided units in the future. The Air Force

(Continued on page 87)

THE BIG STORY

Less than two million days have passed since man's first crude attempt to correlate his thinking and his knowledge with a new science of symbols and hieroglyphics.

And communication is still one of our most undeveloped sciences.

Today, something of great importance is happening at Martin in the technology of communication. It is a new method of harnessing and efficiently utilizing engineering mindpower for the solution of previously impossible design and development problems.

This new operational concept now holds the key to countless closed doors beyond which lie the "impossible" achievements of tomorrow.

Already the Martin concept is revising the calendar and the cost on top-rated projects in the most advanced areas of flight systems development. And the next frontier is space itself.

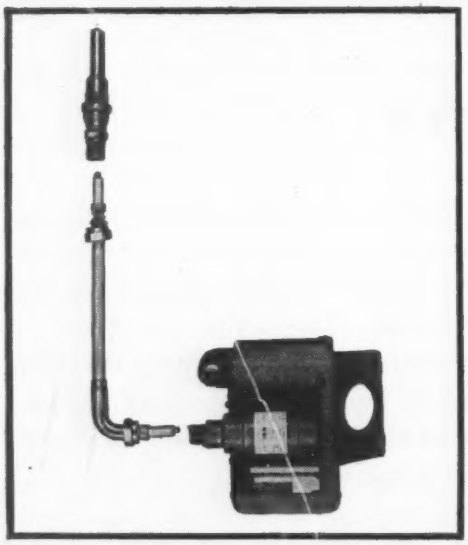
It is a big story.

Come to Martin if you are interested.

MARTIN
BALTIMORE

Bendix Leading Producer of Aviation Ignition

Presents the latest and best in JET IGNITION



Only Bendix provides the complete ignition system for jet engines—Ignition Unit, Igniter Plug Leads, Igniter Plugs and Control Harness.

It is only natural that the world's leading builders of jet engines should look to Bendix* as the logical source of the latest and best in jet ignition.

For Bendix—and only Bendix—has, since the early days of aviation, specialized in the development of every type of ignition to meet constantly changing, higher-performance flight requirements.

Thus, to the solution of today's problems in jet ignition, Bendix brings unparalleled experience in research, engineering, manufacturing and service. From blue print stage to field service follow-through, you can depend on Bendix—the most trusted name in ignition—for the best in jet ignition for today's planes or tomorrow's plans. *TRADE-MARK

SCINTILLA DIVISION,
BENDIX AVIATION CORPORATION,
SIDNEY, NEW YORK

Export Sales and Service: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

FACTORY BRANCH OFFICES: 117 E. Providencia Avenue, Burbank, California • 512 West Avenue, Jenkintown, Pennsylvania • Stephenson Building, 6560 Cass Avenue, Detroit 2, Michigan • 5906 North Port Washington Road, Milwaukee 17, Wisconsin • American Building, 4 S. Main St., Dayton 2, Ohio • 8401 Cedar Springs Road, Dallas 19, Texas • Boeing Field, Seattle 8, Washington • 1701 "K" Street, N. W., Washington 6, D. C.

Bendix

SCINTILLA DIVISION

Bendix AVIATION CORPORATION

stands ready to assist in *any* and *all* efforts to improve air traffic control facilities and service.

Now, let us consider the present air traffic control system and the fundamental philosophy or concept upon which it is based. As you know, the present system is an extensive airways structure which, since its inception, has grown until a good portion of the airspace is covered by airways. Flight operations are conducted by two fundamentally different methods—VFR and IFR. Control is provided only for those aircraft operating under instrument conditions in controlled airspace. Under clear conditions, aircraft flying under visual rules operate in the same airspace with other aircraft flying under instrument rules.

It has become increasingly difficult to maintain visual or pilot separation between aircraft while operating under even the *clearest* of weather conditions. This has been brought about by increased speeds and the resulting increased aircraft closure rates. It is difficult for a pilot to fly high-performance aircraft effectively without almost continuous references to his cockpit instruments. Under the best conditions and even if the pilot is alert, he may not be looking out of the cockpit when a mid-air collision is imminent. This problem is acute at higher altitudes, even though it exists at lower altitudes. "Near-miss" incidents are occurring with increasing regularity, and, in the majority of cases, weather is *not* a contributing factor. It becomes obvious that any system which continues to impose responsibilities upon pilots to maintain clearance from other aircraft is rapidly becoming invalid, if not already so.

The present air traffic situation, with its rapidly increasing volume of aircraft of widely divergent speed ranges from helicopter to jet, with the wide range of pilot skills from novice pilot to the highly experienced, with the minimum equipped aircraft and fully equipped aircraft—all operating in the same airspace, gives indication that special attention must be given to the need for changes in fundamental philosophy.

It would appear that the time has come for modifying this system to provide greater capacity and increased protection for all of us. The concept of which I am speaking would provide military and civil operators with a system compatible with their needs. Under this concept, a portion of the airspace (that which is generally now in use by conventional aircraft) would remain unchanged and would employ both VFR and IFR techniques on much the same basis as currently practiced. At *high altitudes* and in *certain critical high-density areas,* positive separation would be provided during all types of weather conditions. Controlled airspace should be expanded to include these areas. At altitude, control would be exercised on an *area* basis rather than on airways.

Inherent in such a concept is the requirement for ultimate separation of airports for different categories of traffic in areas of high density. Also, it would still be necessary to designate certain airspace and areas to meet specific operation and training requirements. I hasten to reiterate, *this is a concept of what* future requirements may dictate, and one that should be given searching study. Mr. Lowen briefly outlined a high-altitude control plan which constitutes a step in this direction.

While directing our combined efforts toward immediate improvements in air traffic control, we must not lose sight of our objective—a common system which best meets the requirements of all users. A true common system *in being* will provide the maximum readiness possible for our nation's total airpower.

The problems in air traffic control cannot be solved overnight. It takes a planned step-by-step program, money, effort, and time. We have just about run out of time and must really get going if we are to catch up. Only through coordinated *national* effort, and I underscore the word *national,* can we provide for the welfare of our people, industry, and the maximum defense of the country.

• • •

J. B. Hartranft, Jr. [President, Aircraft Owners and Pilots Association]: Is it the ultimate desire of the Air Force to take over the control of the federal airways system or is it the Air Force policy that the federal airways system should as at present be continued under civil administration?

General Bergquist: The Air Force does not want to take on any additional load that it does not have to take on. We feel that the present law places the responsibility clearly on the CAA for air traffic control. At the moment, we have no intention of changing or requesting a change in that law.

"The vital nature of the AF mission to the security of this country" makes it necessary that SAC strike forces (such as these B-47s) get off the ground without delay.

Dr. T. P. Wright [President, Cornell Aeronautical Laboratory, Inc.]: I would like to ask your present concept of the line of demarcation altitude-wise between what you call high-altitude control and the lower altitude systems such as it is now.

General Bergquist: That is something we will have to work out. At present, I think the plan that CAA proposes is a demarcation line at 24,000 feet. We see no reason to differ with that at this time.

Henry Simmons [*American Aviation Daily*]: You mentioned that you thought that ultimately airports in high-density areas would have to be segregated according to traffic. Would you care to elaborate on that?

General Bergquist: I am sure in those cases where it is feasible that the traffic congestion problem could be greatly alleviated by having airports designated for the type of traffic; that is, one for conventional and one for jets.

General Doolittle: I would like to ask a quick one. You have suggested that the altitude level of 24,000 feet be chosen as a separating level for jets and conventional aircraft. What thought has been given to separating the very small low-performance airplanes from the other conventional aircraft?

General Bergquist: I think I would rather leave that to the studies that are being made along that line with CAA and the various committees that are working on it. I have nothing to propose at this time on that problem.—END

the jet age

Flying Safety— The Civilian View

Jerome Lederer
MANAGING DIRECTOR, FLIGHT SAFETY FOUNDATION, INC.

THE most important factor in achieving safety is the will to achieve it.

The attitude of management, pilots, mechanics both in manufacturing and operations was never so good. In spite of recent unfortunate and dramatic accidents, the over-all record is excellent. The headline impact of transport accidents induces the public to overlook the fact that over 42,000,000 passengers were carried by the United States airlines in 1955 with total passenger fatalities of 197.

The desire for safety on the part of the aviation industry stems from a moral maturity, but other more direct factors are equally responsible. Loss of public acceptance, loss of prestige, loss of respect within the industry and loss of revenue, are powerful motivating forces that compel attention to safety.

The minimum cost of a major airline accident is about $2 million. The minimum cost of a major jet accident will be about $6 million and may easily go as high as $10 million exclusive of damage to property or injury to people on the ground.

The industry will continue to rise on the lessons learned from its misfortunes. It is already well on its way to becoming the safest form of transportation.

Short of a perfect record aviation can never be safe enough. I am here to review its trends and to spread before you important safety problems that face it.

Statistics show that air safety has improved as speeds have increased.

The trend in air safety from the public standpoint has been fantastically good. Look at it from the point of view of the person most exposed to flying hazards, the pilot of the scheduled airplane.

In 1921, at the beginning of our present vast system of airways, the air mail pilots continued to fly even though one in every four pilots was killed. In 1932, at the beginning of large-scale transition to modern type multi-engine aircraft, the airline pilot's life expectancy was improved ten times; only one in fifty was killed.

At present the rate is about one in 500. From one fatality in four to one in 500 in thirty-four years while cruising speeds have gone from eighty to 350 mph is good progress. The peak has been as high as only one pilot in 1,000 killed in 1953. Airline pilots no longer need pay an extra premium for their life insurance. The risk of scheduled airline pilotage is regarded by insurance underwriters as no greater than the risks of modern living. . . .

The turbine transport should continue to improve the safety record, especially if certain badly needed improvements in ground installations are provided.

But airline flying is only a segment of aviation activity in the United States. Aircraft engaged in general aviation, such as private flying, business flying, agricultural flying, number more than fifty times the aircraft flown by the airlines, and per year they fly two and one-half times as many miles as the airlines. Even aircraft operated for private business fly more hours per year than the airlines.

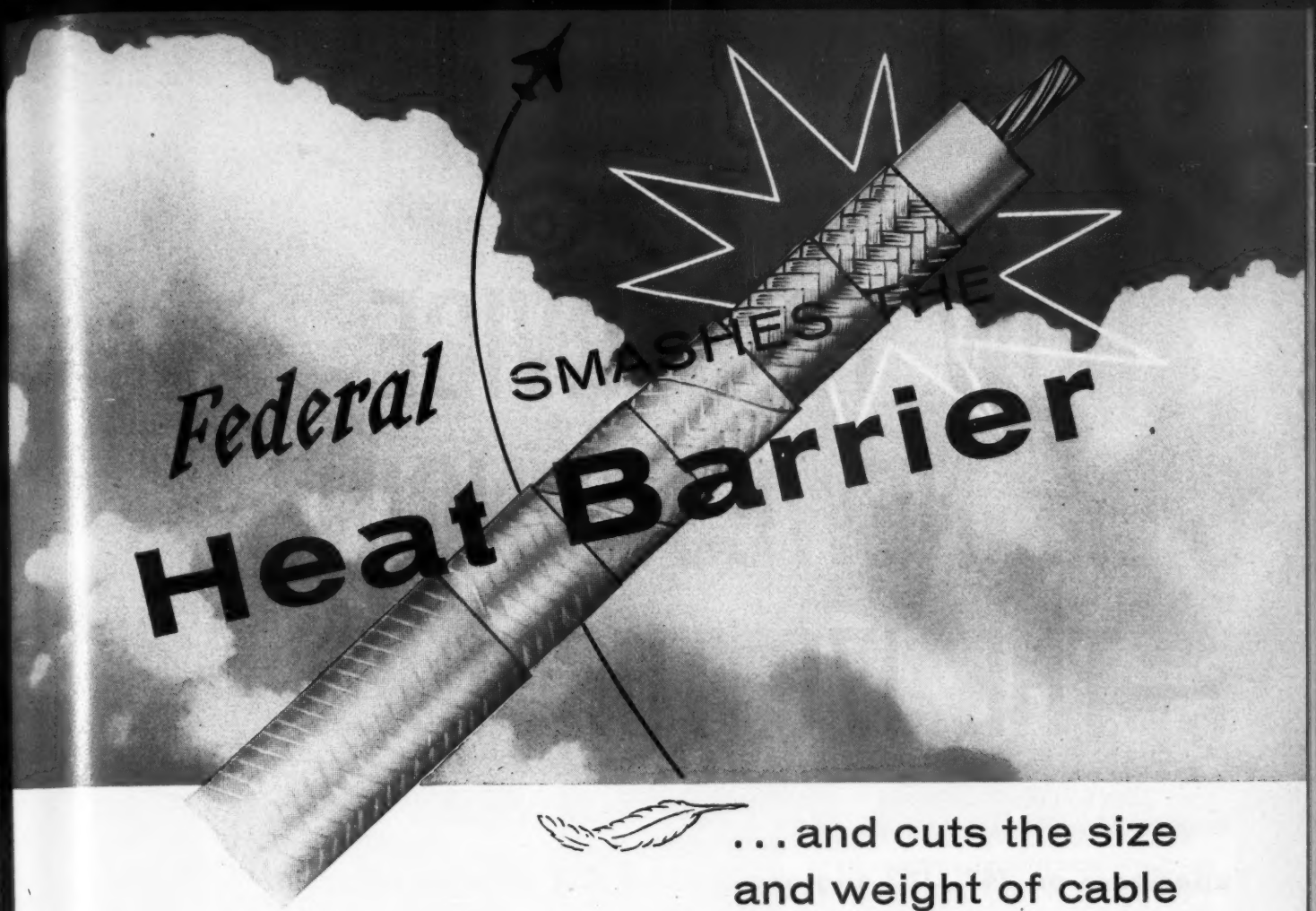
How do the safety records compare?

[The record] shows that flying in company-owned planes is in the same league as airline flying, from the standpoint of the pilots' safety. Translated into life expectancy, the airline pilot flying at the rate of 1,000 hours per year can expect to enjoy 500 years of piloting. The company pilot has a life expectancy of 250 years but his safety is rapidly nearing the airline pilot. In contrast the personal pilot had a life expectancy of only ten years (flying at the rate of 1,000 hours per year).

This should not be confused with the business owner pilot whose record is substantially better than the so-called personal pilot. The better record is due to wider use of better equipped aircraft by more mature owners. The largest percentage of owner pilots is now in the thirty-thirty-nine age group whereas previously it had been in the more irresponsible twenty-twenty-nine age group. Insurance companies now will apply standard rates to private pilots who are over twenty-seven years of age with 400 hours solo time who fly 100 to 150 hours per year. Outstanding safety problems in private flying are well on the road to solution. There remains the question of how rapidly the solutions will be accepted and applied.

In the field of private flying the most significant cause of accidents is flying into bad weather by pilots untrained on instruments and in airplanes not suitably equipped for instrument flying. The result is usually a spiral dive ending in a fatality or serious injury. Gyroscopically operated controls can prevent this, but they are too expensive for the average private airplane operator. The NACA has been developing means to achieve spiral stability at low cost.

(Continued on page 92)



. . . and cuts the size and weight of cable

Federal's miniature coaxial cables—about ¼ the size of comparable RG types—save critical space and weight in aircraft and instrument uses.

Challenged by the high temperature and minimum weight requirements of jet aircraft and guided missiles, Federal has designed RG cables that perform perfectly at a blistering 500° F.! New Federal miniature coaxials have a top temperature rating of 150° C. . . . up to 200° C. with an impregnated fiber glass jacket!

The key to these new cable developments lies in advanced designs.

Based on utilization of "Teflon," this superior dielectric maintains its excellent low loss and high voltage characteristics through a temperature range of 500° F. to −100° F. "Teflon" has no measurable water absorption; it is chemically inert . . . unaffected by alkalies, acids, aromatic fuels, aromatic organic solvents, and highly corrosive aviation hydraulic fluids.

If your cable problems involve heat, space or weight, it will pay you to consider Federal's new "Teflon" insulated cables. For information, write Dept. D-9147.

"TEFLON" HIGH TEMPERATURE CABLES

RG-87A/U 50 ohms; 69.5% V.P.; 29.5 mmfd/ft. Cap; 4,000 operating volts.

RG-140/U 75 ohms; 69.5% V.P.; 29.5 mmfd/ft. Cap; 1,700 operating volts.

RG-141/U 50 ohms; 69.5% V.P.; 29.0 mmfd/ft. Cap; 1,500 operating volts.

"TEFLON" MINIATURE COAXIAL CABLES

K-256 50 ohms; 29 mmf/ft. Cap; 72% V.P.; 850 V rms Corona; 13 db/100 ft. Atten. at 400 mc; 0.095 O.D. dielectric; 7/30 silver-plated Copperweld conductor; 0.135 O.D. jacket.

K-257 70 ohms; 21 mmf/ft. Cap; 72% V.P.; 850 V rms Corona; 14 db/100 ft. Atten. at 400 mc; 0.095 O.D. dielectric; 7/34 silver-plated Copperweld conductor; 0.135 O.D. jacket.

K-258 93 ohms; 16 mmf/ft. Cap; 72% V.P.; 850 V rms Corona; 15 db/100 ft. Atten. at 400 mc; 7/38 silver-plated Copperweld conductor; 0.135 O.D. jacket.

"TEFLON" HOOK-UP WIRE—Type E, EE and FF Hook-Up Wires meet MIL-W-16878A. Available in all standard colors.

Federal
A DIVISION OF IT&T

Federal Telephone and Radio Company

A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
COMPONENTS DIVISION • 100 KINGSLAND ROAD • CLIFTON, N. J.

In Canada: Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., New York

"While our airspace is becoming more congested, it is also shrinking." Much of it is taken up by such things as rocket and missile research. Above, Aerojet's Aerobee.

Lockheed T2V-1 (foreground) uses boundary layer control. BLC is one way of reducing take-off and landing speeds.

And if accidents will still occur due to misjudgment, running out of fuel, power plant failure, the application of knowledge already available for cabin design should enable the occupants to walk away from crashes that in older types of aircraft would be fatal. The design of energy absorbing seats and cabin structures, the delethalized cockpit and the use of comfortable shoulder harness are some of the developments that can be applied to assure survival following an accident.

The industry can also look with confidence to the use of techniques such as boundary layer control to reduce the speed of take-off and landing. This in time should enormously improve the utility as well as the safety of aircraft operations, both commercial and private. But with all these devices, techniques and gadgetry, safety will continue to improve only in proportion to the success with which the industry continues to combat carelessness, incapacity, and complacency. Complacency can result from safety. It is not unusual for airline pilots, for example, to fly fifteen years and never have even an emergency.

Before discussing air traffic control, which is the most critical problem facing the Jet Age, let us quickly review the situation in regard to jet reliability, the hazards of explosive decompression, turbulence, crash fire, and flying qualities.

The simplicity of the large turbine transports should add much to their safety potentials. In one type of jet transport the number of cockpit instruments to which the pilot refers for en route operation is less than on the old DC-3. Utilization per maintenance man hour of jet bombers is over twice that of the large piston-powered aircraft. By the time turbine transports are delivered to the airlines, the military services will have millions of hours of service testing of the same power plants which are to be installed in the transports. Military experience already shows that once a turbine engine is checked out it is more likely to complete the flight without malfunction than the piston engine.

Explosive decompression will be limited in its effect by modern concepts of design based on fail safe, or tear resistance—cracks from any cause will be arrested in their development by tear stoppers. Windows are designed small enough so that if one should break it would take forty-five seconds for the atmospheric pressure inside the cabin to reduce to outside pressure. In the meantime the airplane can descend at 15,000 feet per minute to reach a comfortable breathing altitude for the occupants.

Flying qualities: The consensus of experienced pilots who have flown turbine transports is that these are the most forgiving of all transport aircraft. The important problem from the standpoint of the pilot will be more careful flight preplanning. His en route landing decisions must be made far in advance of the final approach. He should have much better assurance than he has now of being able to land at his destination. All the problems of en route navigation, fuel control, traffic clearances are compressed into a relatively short time, leaving little room for indecision or mental hesitation.

This means more accurate forecasting of en route temperatures and winds and much more certainty of runway ceiling and visibility measurements. These measurements must be made as close to approach and flare path as possible.

The problem of approach and landing accounts for about twenty percent of the airline accidents. The Jet Age cannot afford this. Recent developments in approach lights and runway lights and marking should greatly improve the chances of success. Funds are needed urgently to install these improvements, and thereby also to standardize approach and landing systems. It is not unusual for a pilot to have to accommodate himself to several different lighting systems on one flight. This is inconsistent with American industrial philosophy.

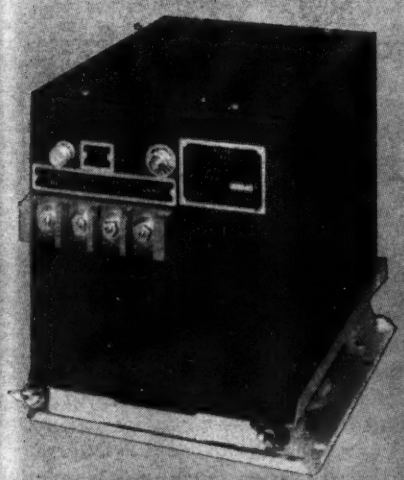
Turbulence, another serious operations problem, is a prominent cause of injury and fatal accidents. Airborne radar, guidance by ground radar, sweptback wings, and design modifications being developed by the National Advisory Committee for Aeronautics should reduce the importance of turbulence as an operating factor.

The terrifying possibility of fire following an accident,

(Continued on page 95)

Beyond the Point-of-No-Return . . .
A New Meaning for Dependability

DOUGLAS C-124



Most Magnetic Amplifier Voltage Regulators now flying are Cline built.

Regardless of the plane or the mission, rugged dependability means everything beyond the point of no return.

Cline Electric supplies new assurance of safe arrival! The Cline Regatrol, wide-frequency-range (380-1000 cycles) Magnetic Amplifier Exciter Voltage Regulator, with the USAF B-1 alternator, now in widespread use on the T-29, C-97, and C-124, has logged more hours of dependable flying time than any other military aircraft voltage regulator.

Cline Electric's Magnetic Speed-Positioning Devices have also proved their dependability in handling other complex electronic control problems.

Cline Electric means rugged, trouble-free dependability.

Controls by **CLINE ELECTRIC**

BUILDING PRECISION INTO TARGET ZERO

Aircraft Products Division
CLINE ELECTRIC MANUFACTURING COMPANY
3405 West 47th Street • Chicago 32, Illinois

IN THE PALM OF HIS HAND

. . . a complete military transmitting and receiving station weighing about one pound!

The "battle maneuvers" illustrated above disclose a new dimension in military communication, made possible by modern transistor developments.

In his hand the officer holds an RCA Transceiver, a complete radio transmitting and receiving unit—the smallest 2-way FM radio ever built. The entire walkie-talkie is only 6″ x 3″ x 1⅛″ in size, with weight, including battery and all accessories, of about 20 ounces.

The men in the field listen to "battle instructions" over tiny receiver units built inside their helmets.

With a range of about a quarter mile, the RCA Transceiver can be pre-set for any frequency between 45 and 52 mcs. Only two controls are used and no tuning or adjustment is necessary during normal use. The receiver is an all-transistorized superheterodyne and the transmitter comprises two transistors and one tube, both contained in a single unit.

The feather-lightness and miniature size of the transceiver and receiver make it possible, for the first time, to extend communication to the individual level. It is another instance of RCA's constant search for new and better ways of doing things electronically. Demonstration and consultation with RCA field engineers throughout the world are invited. Call or write.

RCA Ultra-Miniature FM Transceiver compared with AN/PRC-10 (Walkie-Talkie)

TYPICAL MILITARY APPLICATIONS

- Tactical communications between squad and platoon leaders and higher, also with individual soldier or marine
- Military police and sentry duty
- Air and sea rescue (unit in survival kits)
- Guided missile installations (before and after take-off)
- Communications between maintenance crews, fire crews and between crew and control tower

Medical work (litter bearers to field hospitals) *. . . and hundreds of others.*

DEFENSE ELECTRONIC PRODUCTS

RADIO CORPORATION of AMERICA

CAMDEN, N. J.

which has caused forty percent of airline casualties, is also well on the path towards being overcome by the magnificent research and development undertaken by the National Advisory Committee for Aeronautics. A small quantity of water carried in the nacelle and directed to critical sections of the power plant in case of a crash is effective in suppressing ignition of fuel by the exhaust or other hot sections of the power plant whether it be piston or turbine.

All forms of flying are increasing at a steady rate. While our airspace is becoming more congested it is also shrinking. Much of it is already preempted for military training purposes, for research in guided missiles and for atomic energy tests. TV towers and other high obstructions are creating problems for flying at the lower altitudes, forcing small aircraft and helicopters to fly higher. At high altitudes, or wherever speeds of closure are about 600 mph, the principle of see-and-be-seen to avoid collision is a false hope. The human eye, the nervous system and the inertia of aircraft response react too slowly.

We are already living with a critical collision problem. [According to the Harding Report,] "The collision hazard is becoming greater as increases in civil and military air traffic outpace the capabilities of outmoded traffic control facilities." Fortunately there never has been a fatal collision between two scheduled airplanes. No greater evil could befall aviation than a fatal collision between two large air transports.

JEROME LEDERER, *Managing Director of the Flight Safety Foundation, Inc., was graduated from the College of Engineering, New York University in 1924. He has been Director of the Safety Bureau of the Civil Aeronautics Board; Director of Training for the Airlines War Training Institute; a consulting analyst for the AF; and Bombing Research Analyst for the US Strategic Bombing Survey. In 1950 he received a special testimonial from the Institute of Aeronautical Sciences for his work in air safety research and his contributions to engineering in flight safety.*

But collisions have occurred between airline and other aircraft. There were three last year. For public safety, one is too many. Neither the nation nor the industry can afford collisions in the Jet Age. Traffic controllers are doing a magnificent job with an antiquated system designed to provide separation between aircraft about twenty years ago. It is unsuited for today's traffic, unfit for the Jet Age except at the expense of a vast economic penalty in civil flying and tremendous restriction of military operations. Mr. Selig Altschul, a prominent financial analyst, declares in *The Commercial & Financial Chronicle:*

"Of paramount importance are the navigation and air traffic control systems yet to be evolved to absorb the safe and dependable movement of jet transports. This factor assuring safety of take-off and landing in complex airport and airways traffic patterns is of the utmost significance. *The industry simply cannot afford to risk the economic and financial consequences of a jet transport mishap.* It is obvious, too, that dependable scheduling must be maintained in the air and on the ground. A $5.5 to $6 million jet transport can be very costly to an airline if delayed or immobilized."

Of all problems in air safety both now and in the future, collision prevention is the most important. The problem is to assure separation without encroaching unnecessarily on the freedom of flight. This may call for a new concept of CAR 60—air traffic rules. Area control instead of airway, airspace reserved for the private pilot, complete control in congested areas with less separation than is permissible now.

[The Harding Report goes on to say,] "A recent study by a special committee of airline pilots and operators in conjunction with the Air Transport Association of America indicates that there are, on the average, four reported near collisions involving the airlines daily. The report states that about twenty-five percent of those near collisions had the aircraft passing within 100 feet of each other. Military flying statistics confirm the extent of this danger, which, of course, involves all users of the airspace, private pilots, executive transport operators, as well as the airlines and the military. Only recently has this critical airspace congestion become publicized in the trade and general publications.

"At *mid-1948,* in a study for the Air Coordinating Committee, the Radio Technical Commission for Aeronautics (RTCA), a government-industry advisory group, summarized the then-existing situation as follows:

" 'Every citizen having any acquaintance with flying knows well the inability of the existing techniques of traffic control to handle the present volume of air traffic, particularly under adverse weather conditions. The CAA is charged by statute with regulation of air traffic. The tools available to the CAA to discharge this responsibility are marginal even by prewar standards. Traffic controllers are struggling valiantly to handle an increasingly difficult situation. At present, the only position information available to controllers . . . may be in error by many miles. . . . The position estimates . . . are manually posted and estimates are made from these postings to effect separation of aircraft. With this inefficient set-up . . . for safety reasons, passengers expecting to arrive at Washington at 6:30 p.m. may well land at Philadelphia at 11:45 p.m. The current system is cumbersome, but the controllers have conscientiously tried to keep it safe.'

"Since 1948 total US flying hours have more than doubled, and the air carriers have boosted their passenger-miles from about six to almost twenty billion. Military operations have increased and so have those in the category of general aviation. Controlled traffic is now about equally divided between civil and military.

"At the beginning of this period, both industry and government were predicting airline traffic of only between 9 and 11.5 billion passenger-miles by 1955. In 1951, the CAA revised its figures and predicted that airline passenger-miles would reach 20 billion in 1960. That traffic volume will be attained this year—five years ahead of schedule. This, then, is the first major factor having an impact on the problem: aviation's rate of growth and the load it will put on our facilities are constantly being underestimated in future planning.

"The semi-automatic air defense radar network called SAGE (Semi-Automatic Ground Environment), has been under development since 1949, and will begin operating on a limited basis in the near future. It provides for the automatic transmission of information from a larger number of radar scopes to a central electronic computer, where the data are processed to display pictorially all the aircraft operating over an extensive region. According to publicized reports this system when completed will be able to detect, identify, and track all aircraft over the continent of the United States and its approaches.

"Primarily designed for air defense, SAGE is, to a great

(Continued on following page)

extent, capable of a double duty for air traffic separation as well. Doing this double duty would, in fact, exercise and enhance SAGE's air defense capability. Exploiting this double capability takes on added urgency as we contemplate the additional $260 million which the Civil Aeronautics Administration has discussed spending in the next five years while the military is rushing to completion its $3 billion investment in SAGE and its associated radars.

"Two further points require brief note. Neither of the present systems will be adequate to handle helicopter and other steep-rising aircraft which operate at very low altitudes where ground interference makes radar ineffective. And, if this increasingly popular type of short-range transportation develops as fast as predicted, the time to develop a supplementary system for handling it is upon us.

"Finally, any systems devised in the US must be integrated with what is done by our allies so that our civil and military operations abroad and their operations here can proceed safely and efficiently."

According to the *American Aviation Daily* of January 11, 1956, the CAA requested $67.8 million in 1950 for air navigation items. Budget Bureau requested $42.2 million. Congress appropriated only $37.5 million. For 1956 the CAA requested $26.5 million; Budget Bureau asked for $23.0 million and Congress appropriated $16 million. In this six-year period fixed postings of aircraft at air route traffic control centers have increased from 10,000,000 to 18,000,000; aircraft operations at CAA traffic control towers have increased from 7,000,000 to 14,000,000. During this vast increase in air traffic, appropriations to handle it have been more than halved, and never were more than sixty percent of what the CAA thought necessary.

That is the situation that prevails. Until the air traffic problem is solved we must rely on luck and on the hope that every effort will be made to:

- Discourage any false sense of security on the part of the pilots, both in VFR and IFR flying.
- Review cockpit procedures to reduce paper work, especially during critical segments of flight.
- Organize responsibility for continuous vigilance from the cockpit.
- Review scanning habits of air crews.
- Install the newly developed anti-collision lights.

Aviation safety compares well with other forms of transportation, but it can become the safest of all. The means are here to accomplish it. The will is here, too. The problem is one of funds and for powerful direction.

• • •

From the floor: I have been flying the airlines for thirty years. I would like to ask a question about explosive decompression. As Mr. Lederer said, you can get an explosion in a window. You have forty-five windows, and you have to get down to 15,000 feet for safety. It occurred to me as I looked at that picture of the air traffic over Idlewild that if you superimpose that on Chicago, where there is about twice as much, if I had an explosive decompression on my way from San Francisco to New York, and I dove down through all of that vertical separation of competing traffic, what would happen? [Laughter]

Mr. Lederer: I think you would have to depend on luck. Another reason why you might not descend at that rate might be mountains or maybe there are very turbulent airs. Those are calculated risks, I'm afraid.—END

the jet age

Technological Developments in the Jet Age

Dr. Hugh L. Dryden
DIRECTOR, NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

TODAY, the urgency which spurs our search for the new knowledge to enable us to fly still faster and higher and farther is perhaps greater than at any time in the fifty-two years since the Wright Brothers first took to the air. The effectiveness of the airplane as a potent weapon, for use in waging aggressive war or in deterring attack, is dependent on superior performance in speed, altitude, and range. The improved performance which our program makes possible in military airplanes is reflected not long after in commercial aircraft.

In our efforts to extend maximum performance, we have made great progress, but at the expense of other desirable qualities. Today, even our subsonic airplanes require more than a mile of concrete runway, and the supersonic fighters and near-supersonic bombers now in production need

(Continued on page 99)

Electron optics

In *Charactron*®, as shown above, the principles of a cathode ray tube have been refined with pinpoint accuracy and applied to the presentation of aircraft surveillance data in "SAGE" . . . the Continental Defense System.

The precision required in manufacture is of the highest order.

Heart of the tube is a circular matrix on the face of which, in a ¼" square, 64 minute code characters have been punched. The electronic beam, responding only to processed radar data, selects these characters individually, at speeds up to 10,000 a second—and displays them in groups, identifying targets by type, speed, altitude and track number.

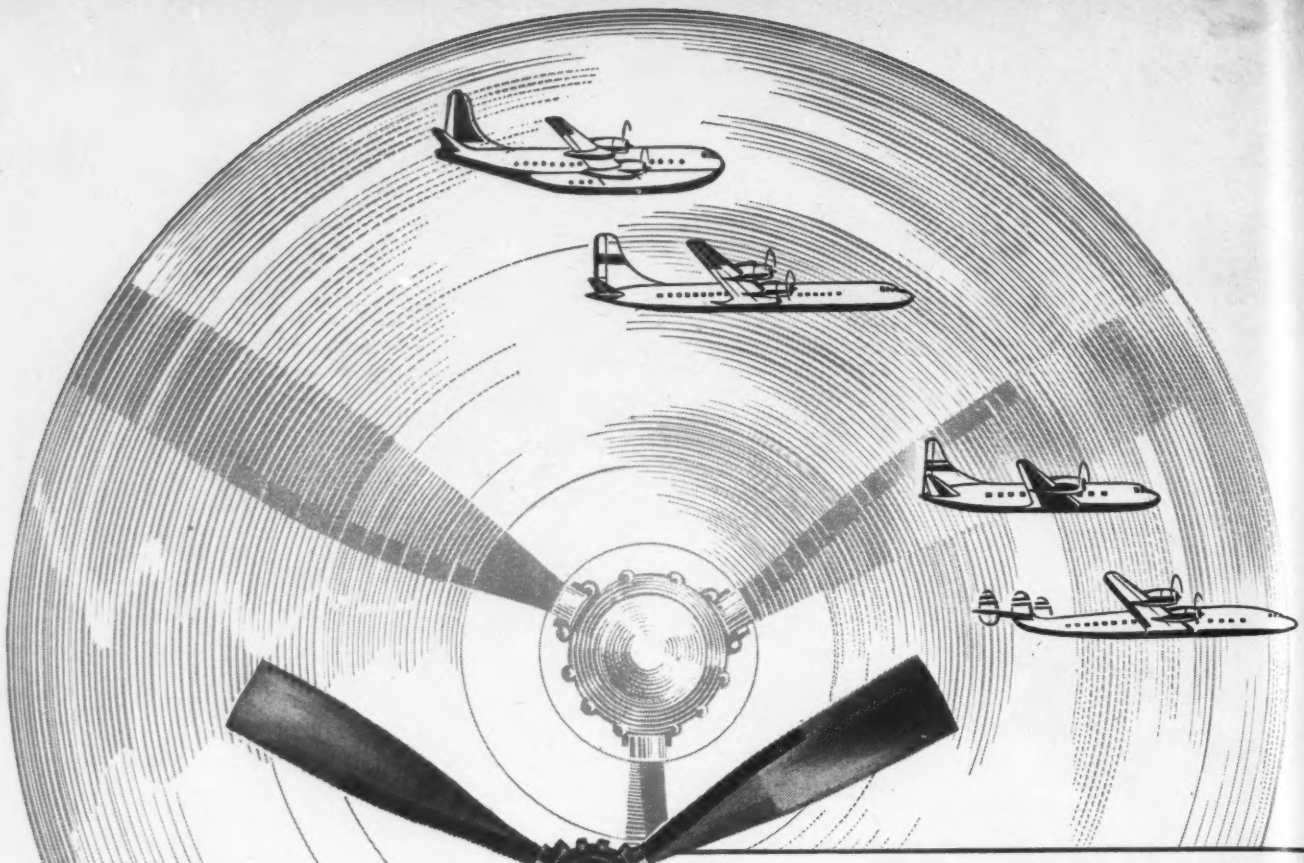
This new tool, the *Charactron*® electron optic tube, has many applications besides that of air surveillance. We'd welcome the opportunity to consider any problem of *yours* which this latest development of precision work in electron optics might well help to solve.

STROMBERG-CARLSON COMPANY

A DIVISION OF GENERAL DYNAMICS CORPORATION

General Offices at ROCHESTER 3, N. Y.

S-C STROMBERG-CARLSON



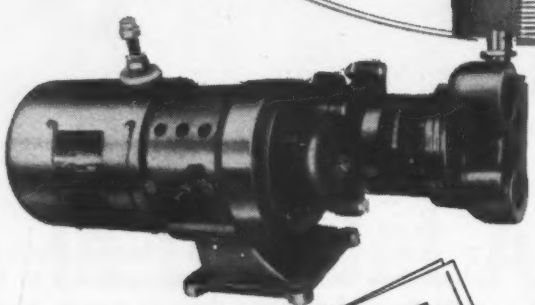
NEW *and* GREAT *Prop Feathering Pumps by* ADEL

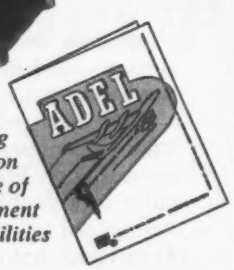
Making Props Behave... Propeller pitch control is a very important factor in starting, flying and landing modern transports smoothly and safely. These new Pumps, products of outstanding engineering abilities and facilities, provide Aircraft Manufacturers and Airlines that *extra* efficiency in Propeller performance.

Precision design and performance characteristics: HIGH CAPACITIES... LOW AMPERAGE... EFFICIENT OUTPUT AT SEA LEVEL AND ALTITUDE OPERATION... EFFICIENT RELIEF VALVE CHARACTERISTICS... EFFICIENT BLEED AND BLEED SHUT-OFF VALVE CHARACTERISTICS... COMPLIANCE WITH DUTY CYCLE AND ENDURANCE REQUIREMENTS. MEET OR EXCEED ALL APPLICABLE AIRCRAFT SPECIFICATIONS.

Making Props Behave

Proven *Quality* costs no more... *Specify* ADEL





Write for descriptive Brochure containing detailed information on ADEL*'s line of Aircraft Equipment and facilities*

ADEL

PRECISION PRODUCTS

A DIVISION OF GENERAL METALS CORPORATION

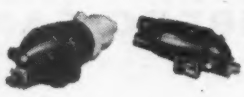
BURBANK, CALIFORNIA · HUNTINGTON, WEST VIRGINIA

CANADA: RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

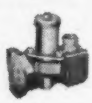
ADEL designs and manufactures aircraft accessories in the following major categories:

HYDRAULIC & PNEUMATIC CONTROL EQUIPMENT

ANTI-ICING, HEATER & FUEL SYSTEM EQUIPMENT



ENGINE ACCESSORIES



LINE SUPPORTS

runways up to twice that length and as much as two feet thick.

Disregarding, for the moment, the dollar implications, we face other very real objections to a continuing of the trend towards ever-longer runways. Real estate, especially in urban areas, is too much in demand for living room and other purposes for us to contemplate indefinite expansion of our airports, civil or military.

Perhaps even more important, from the standpoint of national security, are the military implications. Huge military installations with enormous runways provide inviting targets. They must be located as far as possible from enemy airfields within an adequate defense system. For the more flexible use of airpower, aircraft must be available for use on shorter, quickly prepared runways and on mobile aircraft carriers as well as on permanent air bases.

I need not belabor the point. It is obvious that there is real and urgent need to learn how to build high-performance airplanes, both military and civil, free from dependence upon miles of concrete.

Some time ago, the military issued invitations to bid on a new airplane. Among the performance requirements was one of special interest—the airplane had to be able to take off and land—using plowed fields or ones covered with long grass—within a distance of 300 feet.

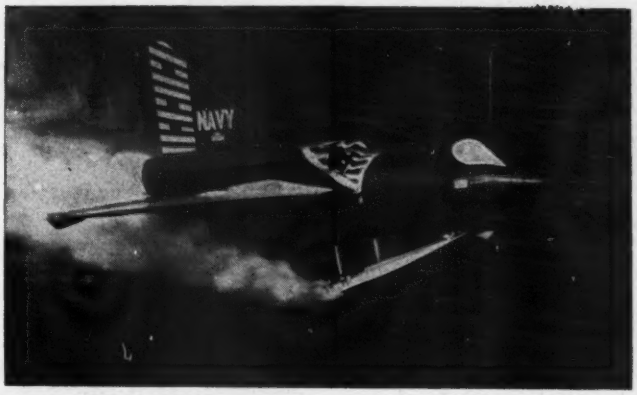
Such short take-off and landing capability is of real current interest. Along with many other types of aircraft, we now think of the STOL as an air vehicle of great potential utility, in peace as well as in war. But, in case you consider the STOL as something brand new—a mid-twentieth century concept—note that the invitation to bid I mentioned was issued in February 1913 to satisfy the Army's need for a Scout airplane.

In the years since then, we have never stopped searching for ways to shorten, or eliminate, take-off and landing runs. Until the last ten years or so, only a small effort in this direction was expended, and the advances made were applied in reducing wing area to permit still greater maximum speed. Learning how to fly fast was itself so big a job that most of our energy was concentrated upon that task. In passing, I might say that this business of learning how to fly faster is still a very big job!

Let us look at the progress made in reducing landing and take-off speeds. In the 'twenties, de la Cierva designed his autogiro. It was a step in the right direction, but one not far enough forward to result in the autogiro's enjoying more than a very modest success. In this period, too, some work was done with high-lift devices—slots, flaps, new airfoils—and a few airplanes were designed and built that could take off after only a very short run. But, again, the emphasis was so much on speed that these airplanes were considered little more than curiosities.

By the end of the 'thirties, the first real answer to the problem had been provided—the helicopter. Vertical take-off, with no forward run, had become possible. I need not recite the many ways in which the helicopter has, since then, proved its utility. The helicopter flies too slowly to suit many needs, and there seems to be little hope of increasing its speed materially. Nonetheless, it is to be expected that there will be substantial further development of the helicopter, and, in fact, we at the NACA are devoting considerable effort to study of problems peculiar to this type of aircraft. Today, however, we are particularly concerned with other types.

Users of aircraft, both military and civil, will doubtless always be like the little boy who wants to have his cake and eat it too. They want vertical-rising, or at least very short take-off, capabilities—plus real speed, preferably



Hydro-skis—one area of research into take-off and landing problems. Above, Navy's Convair XF2Y-1 "Sea Dart."

supersonic speed. Particularly in the case of the military, the need has become so great in the last few years that substantially increased effort has been directed to solution of the many problems involved.

The solutions suggested have been many. You are doubtless familiar with the concepts: The VTO, the zero-launcher with its corollary, the air-mattress landing gear; the hydro-ski and the pantobase; the coleopter; the STOL—my list is by no means complete. The combinations and permutations of the devices which seem to offer the possibility of both short take-off and high speed are seemingly infinite.

What I propose to do now is to discuss some of the possibilities from the point of view of the research man. At the laboratories of the NACA, we concern ourselves with the problems of aerodynamics and structures and propulsion—to explore, to measure, to provide design information. It is not the NACA's business to attempt the design of new air vehicles or their engines, any more than it is the NACA's business to ponder such very real problems as operating costs and production feasibility. The military and the commercial operators make known their needs; the industry determines how well it can satisfy those needs, and then designs and builds the end product. We at NACA realize full well that the job is by no means done when we have completed our part of the task.

First, consider briefly the VTO concept. It is of special interest to the military because it combines the capabilities of vertical lift and high speed in forward flight in a single aircraft. What makes this concept attractive now is the development of jet engines with a very high thrust-to-weight ratio. In order to fly very fast we have to provide our aircraft with very powerful engines of low weight, so powerful in fact that they could lift the aircraft straight up, as easily as they could propel it at supersonic speed.

One of the simplest types of VTO aircraft is one that stands on its tail, pointed upwards. Either turboprop or turbojet engines can be used. Because its engine provides enough thrust to overcome its weight, it can take off and climb, straight up. Once in flight, the VTO tips over to a horizontal position, and moves forward, quite fast. In landing it backs down tail first.

Unfortunately, the VTO involves problems other than sufficient thrust. How to keep the aircraft thoroughly under control during the critical periods of take-off and landing are lumped in the deceptively uncomplicated phrase—stability and control. At the NACA we have been studying various aspects of this very large problem for the past seven or eight years. Real progress has been made.

You are all familiar with the VTO prototypes which

(Continued on following page)

Convair and Lockheed have built and flown. I don't think it is any secret that other companies are active in this field, actually making hardware, to use a phrase popular in the area of development.

There are, of course, variants of the VTO. The coleopter—an exotic French name for the combination of ring airfoil and ducted fan—is one of these. Announcement has been made that Kaman has a Navy contract for a coleopter. Still another way to design a VTO is the flying platform. Charles Zimmerman, an aeronautical research scientist at our Langley Laboratory, patented the idea of having the operator of the flying platform stand on top of a ducted fan or a small rotor. What is novel about the flying platform is the simplicity of control; all the operator does is lean in the direction he wants to go. Hiller and deLackner have built flying platforms, the former for the Navy, the latter for the Army.

The zero-launcher approach places an essentially conventional airplane on the same kind of zero-launching track that would be used for a guided missile like the jet-propelled Martin Matador. What gives the zero-launched airplane the necessary kick in the pants to get it into the air is the same kind of JATO-type rocket used to start the Matador on its way. Here again, I am speaking of something entirely possible. Martin has modified a Republic fighter and made zero launchings. At the end of such a flight there are at least two possibilities. If the airplane has sufficient range to get back to conventional runways, it can, of course, use conventional landing gear. If not, it can come down on a mattress-like affair. Again, let me say I am not talking fantasy; such landings have been made.

DR. HUGH LATIMER DRYDEN, *Director of the National Advisory Committee for Aeronautics, began his scientific career in 1918 as a laboratory assistant in aerodynamics at the National Bureau of Standards. He is internationally known as an authority on the mechanics of air flow and has won many honors, including the Wright Brothers Memorial Trophy for 1955. During World War II he led development of America's only successful guided missile to see combat (the Navy's "Bat") and later served on the post-World War II AF Scientific Advisory Group.*

Hydro-ski and pantobase types are not, strictly speaking, aircraft with short take-off capability. But they must be considered in any thinking about ways and means of freeing our airplanes from long, man-made runways. Not long ago, a British engineer, P. G. Fielding, put it this way: "The heart of the problem is to devise an indestructible airfield, if the all-out effort required by atomic-age war is to be maintained. This presents an imposing task for airfield engineers; so another medium has to be found. Fortunately, we can use a medium that surrounds us and covers, as every one knows, three-quarters of the face of the world; for all the bombs ever made will not change the character of an airstrip consisting of a stretch of water."

Research by the NACA on the hydro-ski concept has been in progress for nearly ten years. At first, the obvious goal was a way to adapt a wing-fuselage shape capable of high-speed flight to the special requirements of water-based airplane design. Again, it was the turbo-jet engine which made the idea attractive, because the engine no longer had to be positioned high in the air away from spray and waves. The first hydro-skis were just that—flat, ski-like structures that could be retracted into the fuselage after take-off. The Convair Sea Dart incorporates skis of improved shape. Since then, research has continued to learn how to improve hydro-ski characteristics, both aerodynamically and hydrodynamically.

The logical extension of this idea is landing gear that will be suitable for use on land—concrete, sandy beaches, sod, snow, and ice—as well as water. Today, we refer to airplanes so equipped as pantobase. All American, Grumman, and Stroukoff have been doing full-scale flight test work with both small and large pantobase airplanes. But again, let me caution against any thinking that the pantobase is a new idea. Remember the "Triad"—so-called because it was at home on land or water and in the air—which Glenn Curtiss built and sold to the Army and the Navy in 1911?

Even less far removed from present practice of using conventional airplanes and long runways is the possibility of reducing take-off and landing runs by use of boundary layer control. For more than a half century, since Prandtl's earliest work, boundary layer control has been in the unhappy state of being always a bridesmaid and never a bride. Everyone recognized the possibilities inherent in control of the boundary layer, but the cost in weight and complexity was so high that flaps and slots and leading edge slats—which themselves were very helpful in achieving higher lift—inevitably were used.

Now, it seems as if the boundary layer control may actually find favor—and become a bride. The thinner wings we are using today, to attain higher speed, makes more difficult the job of designing aero-dynamically effective flaps, and even more difficult the task of building them. The jet engine provides a ready, and not too costly, supply of air to draw in, or blow off, the boundary layer. Right now, the most likely use of boundary layer control is on Navy carrier-based aircraft, where reduction of stalling speed by even a few knots is very important.

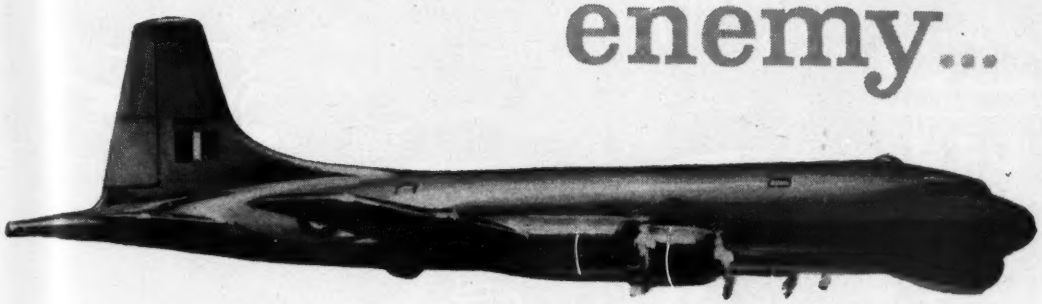
In the future, it may be used as a landing and take-off aid on Air Force and commercial jet airplanes, but in such instances, it is to be expected the application will be more to enable new aircraft of improved performance to use existing, long runways, rather than to permit markedly shorter take-offs and landings. Again, I am speaking of a concept that is not brand new. Even before the end of World War II, the Germans had worked vigorously on the idea of applying boundary layer control to one of their Arado bombers. Here in the United States, a number of experimental boundary-layer-control installations have been made, and now are receiving flight evaluation.

By its very name, the convertiplane suggests the dual utility which we in America—with our station wagons that serve equally well as a small truck and the go-to-church car of the family—hold so dear. It is an aircraft that takes off like a helicopter and then, after the rotor system has been transferred into a set of giant propellers, flies like an airplane. Here again, we have an idea that goes back a good many years, as any of the several convertiplane pioneers of the greater Philadelphia area will quickly tell you, and have already told you.

Many variants of the convertiplane idea have been suggested. Instead of just tilting the propeller-rotor system, some workers in this field would tilt the entire wing. That either proposal *can* be made to work, providing sufficient development effort is invested in the project, no one doubts. Whether such a device would prove feasible for military or commercial use depends on the same considerations of production cost, operating economy, etc., which

(Continued on page 103)

To seek the hidden enemy...



Soon, the oceans around Canada will be patrolled by the first aircraft developed specifically for Canadian maritime reconnaissance duties . . . the Canadair-designed CL-28.

Developed from the Bristol Britannia class by Canadair, this is the largest aircraft ever to be manufactured in Canada and we at Canadair regard it as a tribute to our capabilities that the RCAF selected us to do the job.

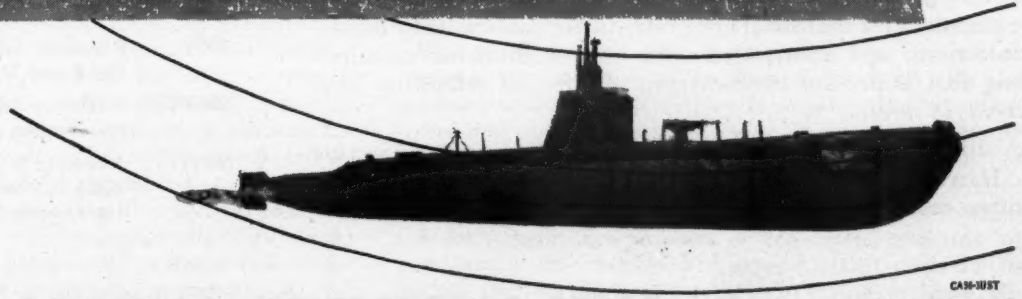
Size, of course, is not the only factor, for we are equally at home in the design and production of jet fighters, training planes, airliners, guided missiles or even components for other aircraft. What counts most is our outstanding record for cost performance, on-time deliveries and quality of manufacture.

CANADAIR

LIMITED, MONTREAL, CANADA

AIRCRAFT MANUFACTURERS

A subsidiary of GENERAL DYNAMICS CORPORATION, New York, N.Y.—Washington, D.C.



CA56-10ST

CANADAIR HAS PRODUCED MORE JET AIRCRAFT THAN ANY OTHER CANADIAN MANUFACTURER

specifically designed for critical industrial application

RCA "Special Reds" . . . *warranteed for 10,000 hours minimum operating life* . . . are in a class by themselves for industrial application demanding the finest in tubes.

Only RCA "Special Reds" feature 10,000-hour *plus* life, exceptional resistance to shock and vibration, remarkable *stability*, and excellent *uniformity* of characteristics from tube to tube.

RCA "Special Reds" are recommended for initial designs in electronic equipment for industrial applications, air, marine, land-mobile communications, and unattended relay and transmission circuits—providing that important extra-margin of life and reliability vital for *continuous service.*

For details and data, write, RCA, Commercial Engineering, Section C53R, Harrison, N. J. or contact your RCA Field Representative at the office nearest you.

RCA-5690—Full-Wave Vacuum Rectifier with separate heaters and cathodes.

RCA-5691—High-Mu Twin Triode. Similar to RCA-6SL7-GT, but has twice the heater current.

RCA-5692—Medium-Mu Twin Triode. Similar to RCA-6SN7-GT.

RCA-5693—Sharp-Cutoff Pentode. Similar to RCA-6SJ7.

EAST: HUmboldt 5-3900
744 Broad Street, Newark 1, N. J.

MIDWEST: WHitehall 4-2900—(Suite 1181)
Merchandise Mart Plaza, Chicago 54, Ill.

WEST: RAymond 3-8361
6355 East Washington Blvd.,
Los Angeles 22, Calif.

RADIO CORPORATION of AMERICA
TUBE DIVISION HARRISON, N. J.

must be pondered when any of the other aircraft we have been discussing are proposed.

In the United States and elsewhere, aircraft people are also working on the problem of how to use turbojet engines in place of the propeller-rotor system of a convertiplane. In other words, install jet engines that during take-off and landing would be pointed downward to provide vertical thrust, and then be tilted to the horizontal position to give the desired thrust in forward flight. Bell Aircraft has built a flying test bed to carry forward its work in this area. In Great Britain they have a similar project which they call a flying bedstead.

Still another way of accomplishing both vertical flight and jet-engine speed is to mount the powerplants in a permanent, horizontal position and then—using vanes or other suitable devices—turn the jet blast downward or rearward. Some thirty years ago, Zahm suggested the idea of using a venetian-blind wing on an otherwise conventional, propeller-driven airplane. For several years, at our Langley Laboratory we have been working with small models—powered either by electrically-driven propellers or externally-supplied compressed air jets—which demonstrate the possibility of achieving satisfactory stability and control, both in forward flight and in the more critical take-off and landing phases.

Among the most recent work at the Langley Laboratory has been a study of the aerodynamic, stability and control, and propeller characteristics of four-engine, propeller-driven, vertical-take-off transport airplane models. The models have fuselage shapes similar to modern transport planes. The work was premised on the requirements that—in normal forward flight—such aircraft should be efficient and have good flying qualities. It was assumed that for such basic considerations as passenger comfort and cargo loading, the fuselage should remain essentially horizontal at all times. Both the tilting-wing and the venetian-blind wing were studied experimentally as well as theoretically. For the tilting wing, our engineers noted that "this involves some obvious mechanical complications." For the other arrangement, while it was conceded "the mechanical complications may be somewhat less severe," it was cautioned that "there are some obvious problems involved."

The layout of the hypothetical airplane was not intended necessarily to represent an optimum design, or even a design in which a VTO transport would find its greatest usefulness. It was based on use of four Allison T-56 turboprop engines driving twenty-foot-diameter propellers producing a total static thrust of 63,000 pounds. Design gross weight was 60,000 pounds with a useful load estimated at 19,000 pounds. This included forty-five passengers or 10,000 pounds of cargo, 500 pounds for crew, and 8,500 pounds of fuel. Maximum still-air range, at 40,000 feet altitude—at a speed of 460 mph—would be about 1,500 miles. With necessary allowances for climb, let-down and fuel reserve, the commercial range would be something less than 1,200 miles.

It was calculated that a conventional airplane—using conventional runways—could achieve the same load, speed, and range as the VTO transport with one-half the power, and that it would weigh only seventy-five percent as much. With frank admission, our people were not in position to judge how operating costs would compare, or to assess how much the VTO and landing capability would be worth. They did conclude, however, that on the basis of the current state of the art, VTO transport airplanes which can be designed and built today could perform useful service in certain military and commercial operations. As engines of lighter weight become available and additional knowledge is acquired, their performance can be substantially increased. • • •

Henry Simmons [*American Aviation Daily*]: Could you give us any indication with respect to the success in research involving the actual control of the weight of the airplane by controlling the forces of gravity or otherwise?

Dr. Dryden: I know of no way of controlling gravity other than those ways which are familiar to all of you.

Mr. Simmons: What would you say would be a desirable power-to-weight ratio to a commercial VTO?,

Dr. Dryden: I do not know how to give you a figure which will stand up. Do you want to know whether it would be ten percent more thrust or twenty percent more thrust? Certainly, if the thrust margin is too small, you are going to get into certain types of difficulties. You see, you not only want to stand still with respect to the air, but you want to stand still with respect to the ground. Of course, if the air moves with respect to the ground and the thrust margin moves, you have a small margin for dealing with wind, gusts, and thrusts. I do not think we have made a sufficient number of studies to know how to fix the figure precisely. It probably will be somewhere in the range of ten percent to twenty-five percent margin, in that general area.

James Fine [Navy Department]: Isn't one of the hopeful areas of this short take-off aircraft the possibility that we can have the VTO aircraft and that by calculated overload it can perform very satisfactorily?

Dr. Dryden: Yes, I think this is quite true. The power relationships on these airplanes are somewhat different from those that you are used to with conventional aircraft. I think that the answer will come out just about the way you suggest. If you start out to design a short take-off aircraft, you would have to put enough power in it for satisfactory operating margin so that under good conditions it would be able to take off vertically.

Dr. T. P. Wright [President, Cornell Aeronautical Laboratory, Inc.]: Dr. Dryden, you spoke of the penalty that would be incurred in terms of weight and power by using one configuration of STOL. I understand that in case of boundary layer control, if you could get complete drag reduction as well as lift augmentation, almost exactly the reverse figures would appear. In other words, you could decrease the power and decrease the weight because of the reduction in drag. Do you think that it is at all possible or reasonable to concede that we will practicably get drag-reducing boundary layer control so combined with such augmentation that we will wind up without a penalty?

Dr. Dryden: There is still quite a lot of work going on about producing drag in boundary layer control. In this area, wind tunnel measurements are less satisfactory for technical reasons, which I will not explain here. It comes about because of the disturbances which are normally present in wind tunnels. On some small models, it is difficult to get the surfaces of comparable smoothness.

The chief question at the moment is the operational one—can you maintain an airplane in the field with the necessary smoothness of surface to maintain the boundary layers that you can produce under laboratory conditions? I think that some work of this kind will probably go forward. In other words, the boundary layer control measurements in the research laboratory have reached a stage where the problem of the operational use of boundary layer control of drag reduction needs to be investigated in the field by actually trying to build airplanes and seeing if you can realize these reductions.—END

the jet age

Resources for Readiness-in-Being

The Honorable Donald A. Quarles
SECRETARY OF THE AIR FORCE

THIS IS my first opportunity to see for myself the excellent job that the Air Force Association is doing in its series of conferences on major areas of Air Force activities. These conferences are especially valuable to us, for they provide a forum in which the Air Force can outline its problems before just exactly the people who are best able to tackle those problems and suggest workable solutions. . . .

It is a well established fact, and one we need not dwell on today, that atomic weapons and the capability of the United States Air Force to deliver them have represented the major deterrent to aggressive inclinations of the Communist bloc.

But that coin has two sides and if the Communists should, against all reason, determine to plunge the world into war, this nation must expect to be the first and most important target. Never before have we been in danger of direct attack which can wreak catastrophic damage across the country in a single day. Yet air/atomic power in the hands of an enemy makes this prospect a harsh possibility.

The impact of any all-out war will be instantaneous upon us all. This fact wipes out any possibility that we may ever again have time, after total war is upon us, to build up our industrial capacity. It is a fact we must accept and be ready for.

The difficulty of preparing for this possibility is underscored by our experience in World War II. It took us almost four years to reach peak production after the President called for a build-up in aircraft production capacity.

However, we *do* have conditions today which improve our position over that we faced fifteen or so years ago. We are maintaining armed services designed to meet the threat of global or limited war, and in those services an Air Force possessing immensely more fire power and global capability than we have ever known before.

In World War II we found it necessary to send formations of hundreds of bombers to hit a critical target, and they often had to return again and again to keep it out of action. Today a single bomber, or a missile, can deliver on a target as much explosive force as all the World War II bombers combined.

I do not believe that we will ever again have to employ our airpower and weapons as we did in Korea. If we are again forced into armed combat we will use the weapons most appropriate to targets and missions. It must be clear to any aggressor that he can expect to be opposed with the kind of weapons necessary to make his aggression both painful and unprofitable.

As part of our structure to oppose Communist aggression, and particularly to meet the threat of a local outbreak of war, we are providing military assistance to our allies. We use this phrase so often around Washington that it has become almost a cliché, but recently I have had an opportunity to see its practical application during a tour of our Far East installations.

In three weeks, from the day after Christmas to the middle of January, I visited Air Force installations in Japan, Korea, Okinawa, Taiwan (Formosa), Thailand, Viet Nam, the Philippines, and some of the other Pacific islands.

I was most strongly impressed with how much so many people are counting on us and how much we in turn need their confidence and their loyalty to the Free World cause.

I saw and talked with many great men of the Far East and Southeast Asia—men like President Magsaysay of the Philippines, President Rhee of Korea, President Diem of Viet Nam, Prime Minister Pibul of Thailand, and, of course, Generalissimo Chiang Kai-shek of the Chinese Republic on Taiwan.

They are our friends. They are as determined as we are to prevent the spread of Communism, for most of them have faced Communists in armed struggle and know all too well the Communist tactics of violence, duplicity, and mockery of truth and justice.

In a material sense. we have a lot more to give them than they have to give us, and this is particularly true in this day and age of modern airpower; but it seems to me that, if they match our material contribution with the spiritual stuff that it takes to stand firm on the firing line against great local odds, we have at least a fair partnership deal.

We have partners in fact that we can treat with the

(Continued on page 107)

Cessna T-37 designed for Jet Training

To meet jet age demands, the U. S. Air Force requires a jet trainer that makes it easy for cadet-pilots to master first line combat airplanes.

The Cessna developed T-37 introduces the cadet to all combat jet airplane characteristics while training on this safe, easy-to-fly jet trainer.

It is designed to provide the Air Force with a jet trainer that can be operated at substantial savings and cover the most important and longest phase of the cadet-pilot's jet training.

It is a privilege for us here at Cessna to team with the Air Force in its forward-thinking plans for the jet age. CESSNA AIRCRAFT COMPANY, Wichita, Kans.

Cessna

For Air Force cadet-pilots, a safe, easy step into first line jets.

Be an Aviation Cadet. Inquire today about the future your Air Force offers from your Air Force Recruiting Office.

Underwater Aircraft Carrier...

Long-range striking punch of Regulus guided missiles strengthens your new Navy's powerful underwater fleet

Bold, advanced concepts—atomic power and guided missiles like Vought's pin-point accurate Regulus—help make Your New Navy the most modern force of its kind in the world.

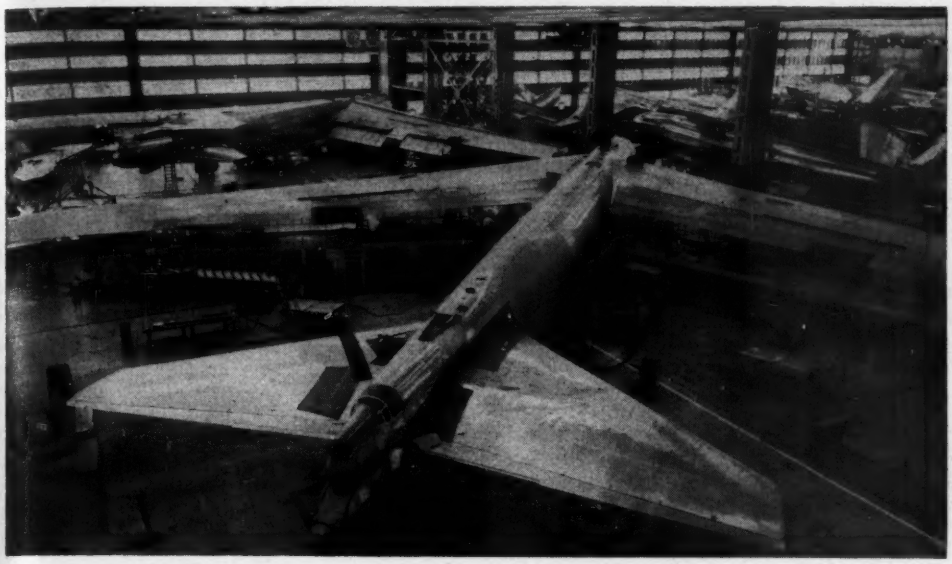
Submarines capable of cruising around the world without surfacing or refueling now can serve also as *aircraft carriers*, with potent, dependable guided missiles giving wings to their deadly striking power.

Regulus thus brings Air Power to the Underwater Fleet—another example of how Vought engineering ability results in weapons that help strengthen the U. S. Navy in its vital mission, control of the seas that cover 70 per cent of the world.

SCIENTISTS AND ENGINEERS: There is a challenging place for you on Vought's creative technical team now. For details write: Engineering Personnel, P. O. Box 5907, Dallas, Texas.

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

DESIGNER AND BUILDER OF HIGH PERFORMANCE MILITARY AIRCRAFT SINCE 1917



Industrial readiness in action. This is the final assembly area for giant Boeing B-52 Stratofortresses at the Wichita, Kan., plant. The big bombers have also been in quantity production at the Seattle plant since March '54.

respect of full brothers in arms. If you could have seen for example the pride with which General Kim in Korea or General Tiger Wang in Taiwan demonstrated the great progress they have made in building up truly modern air forces in their countries, I think you would agree that we are dealing with splendid partners and that we probably buy as much security for ourselves and the Free World with the dollars of military assistance to these partners as with any other dollars we spend.

As for our own forces, we are on course toward our goal of 137 wings by the summer of 1957. By the end of this fiscal year we will have 131 wings. We already have on hand or on order all the aircraft and related equipment we will need to provide the weapons systems for our 137 wings. And, except for a few heavy bombers, all our combat aircraft will be jets. The exception is the B-36, which held the line as a global deterrent to war for almost a decade while the all-jet B-52 was coming into operational use.

We are continually modernizing other wings, too. For example, we announced a week ago that we are replacing our F-86 Sabrejets in Europe with F-100s. This is the first of our supersonic Century Series fighters, but others are not far behind. The F-101, F-102, and F-104 are in production and will soon take their places in operational squadrons. All of our medium bomb wings employ B-47 jets which use aerial refueling to increase their range or bomb load. The B-57 is rapidly taking the place of our B-26s, and tactical missile squadrons are operational in the US and in Europe.

Our latest fighters are being equipped with air-to-air missiles. Other missiles of all types are under intensive development, including the long-range ballistic missile. This year some eleven percent of our procurement dollar is being spent on guided missiles. Next year the percentage will be substantially greater.

In collaboration with the Atomic Energy Commission and a number of airframe and engine contractors, experiments are proceeding on nuclear power for aircraft. This is inherently a difficult problem, particularly when we insist on meeting weapon system requirements, but good progress is being made.

Progress is also being made in expanding our facilities for detection and identification of attacking aircraft. We are extending the early warning system by constructing, jointly with Canada, a warning net north of the Arctic Circle to supplement those already existing or under construction along our northern border and in central Canada, and by setting up Texas Tower radar stations in the Atlantic approaches to the United States. The Navy is operating picket ships off both our coasts, and radar-equipped Air Force search aircraft patrols fly far out over the oceans at altitudes which greatly extend the effective range of their airborne early warning equipment.

To process the information collected by these and other sources—including volunteers of the Ground Observer Corps—we have developed and are setting up the SAGE network which employs automatic computers to solve the complicated mathematics of air defense and to calculate interception patterns to be flown by our fighters in destroying enemy bombers.

We have good reason to expect that the airpower I have described will continue to be an effective deterrent to keep an enemy from starting a war.

This long pull effort against war is expensive—though much less expensive than war itself.

In a few days we will go before Congress on the Air Force budget. As you know, the President's budget for fiscal year 1957 includes about $16.5 billion for the Air Force, which is almost half of the total Defense budget.

We support this budget. It will advance us toward our goal of the 137-wing Air Force. It is tight and austere, with no room for luxuries. But we can live with it.

It corrects one major problem uncovered in the current fiscal '56 budget. Funds allotted to operations and maintenance for the current year are too low. As a result of this experience, the '57 budget contains an increase to make up for deficiencies in those categories.

I see no reason to believe that our budget can go any lower in the near future. In fact, those of us close to the picture expect defense to become more and more expensive, as the items necessary to that defense grow more complex and the technical competition gets tougher. It does not seem unreasonable to expect, however, that as our national economy continues to expand, and as the economic status of our partners around the world improves, we may be able to finance our defense requirements without a larger proportionate drain on our economy.

(Continued on following page)

There is one area, however, in which we must focus more attention, and be prepared to spend more money. We are accustomed, particularly in a group like this, to talk about hardware and research and new equipment to strengthen the Air Force. But I am convinced that no weapon would contribute as much to the effectiveness of the Air Force as would a solution to our problem of attracting and keeping qualified people.

The pay raise passed by Congress last year was a step in the right direction: it has contributed to an increase in reenlistment which has more than repaid the higher cost. But we are finding that, if we are to hold good men, we must be *able to compete with* the offers that industry is making to them.

To do this we must sponsor and support the very prosaic projects of housing, recreational facilities, medical care for dependents, and survivors' benefits, as well as the opportunity of earning pay *closer* to what a serviceman might earn in civilian life.

We must get away from the concept that it is reasonable and proper for a serviceman's pay to be well below that which he might earn in civilian work. This concept might be all right in time of war when the entire nation is mobilized for victory. But we are engaged in the long pull, when we must maintain forces at the ready for an indefinite period. We cannot expect patriotism and pride of service to outweigh a significant disparity of compensation, particularly when it affects a man's ability to provide reasonable comforts for his family.

Up to now, I have described one element of the airpower equation—the Air Force in being, made up of our men and the weapons they employ. I am confident that in striking power this Air Force in being is superior to that of any other nation. It represents the combined efforts of the Air Force establishment, the creative and research talents of American scientists and engineers, and the products of our industrial facilities—all supported by the tax dollars of our people.

The second element of our airpower also combines these same factors, but you of the aircraft industry are the primary agents. It calls for an industrial capacity to produce *now* the equipment we need to maintain this Air Force in being. It requires us to take full advantage as soon as possible of new technological developments to keep the in-being Air Force modernized. We must combine our talents to cut down the period between research and development in new weapon systems and the date they become available for operational use. In light of recent Soviet accomplishments, we must improve our performance in this area if we are to maintain our leadership.

We must also be prepared for rapid acceleration of production if we are forced into a peripheral war, for we must be able to satisfy the airpower requirements of that type of conflict—perhaps even two or more such situations simultaneously—without reducing our global deterrent capability.

Finally, we must accept the possibility of an attack aimed directly at us which will plunge the world into general war. If that comes, we cannot expect a World War II type build-up, but must fight with what we have and make the best use of whatever is available to keep this force going.

As you see, this philosophy requires a significant change in our previous policies both for industrial preparedness and for industrial dispersal, which is really a part of our preparedness picture. We must always keep uppermost in our minds that the vital element in our deterrent strategy is the strength and readiness of our in-being retaliatory force. The resources made available for national defense are not always adequate for all the things we would like to do. If a choice must be made between maintaining our retaliatory force in the best condition of readiness on the one hand and diverting money to industrial preparedness on the other, it may well be necessary to choose in favor of our force in being.

THE HONORABLE DONALD A. QUARLES—*Before he became Secretary of the Air Force in August 1955, Mr. Quarles had been Assistant Secretary of Defense for Research and Development, a post he had held since September 1953. Before then he was a vice president of Western Electric, and president of the Sandia Corp. He was born in Van Buren, Ark., on July 30, 1894, and is a graduate of Yale University. He now considers Englewood, N. J., his home. In January 1954 he was named first chairman of the Air Navigation Development Board by the Secretaries of Defense and Commerce.*

It is within this general philosophy that our new industrial readiness policy is based. The policy, which is intended primarily as a guide for our procurement officers, includes three major elements; I might summarize them as dispersal, hardness, and flexibility.

First, dispersal. Though our policy on dispersal was issued separately, it is properly and logically a part of our industrial readiness plan. An aircraft industry whose components are well dispersed is obviously less vulnerable to enemy attack than one concentrated in major population centers, particularly along our coasts. When we have a choice, we will build new production sources away from lucrative target areas. Dispersal is a prime consideration in selecting sites for new facilities furnished at federal expense or built with federal aid. Within the philosophy of getting the best possible Air Force in being out of our available dollars, we intend to keep the pressure on to encourage dispersal.

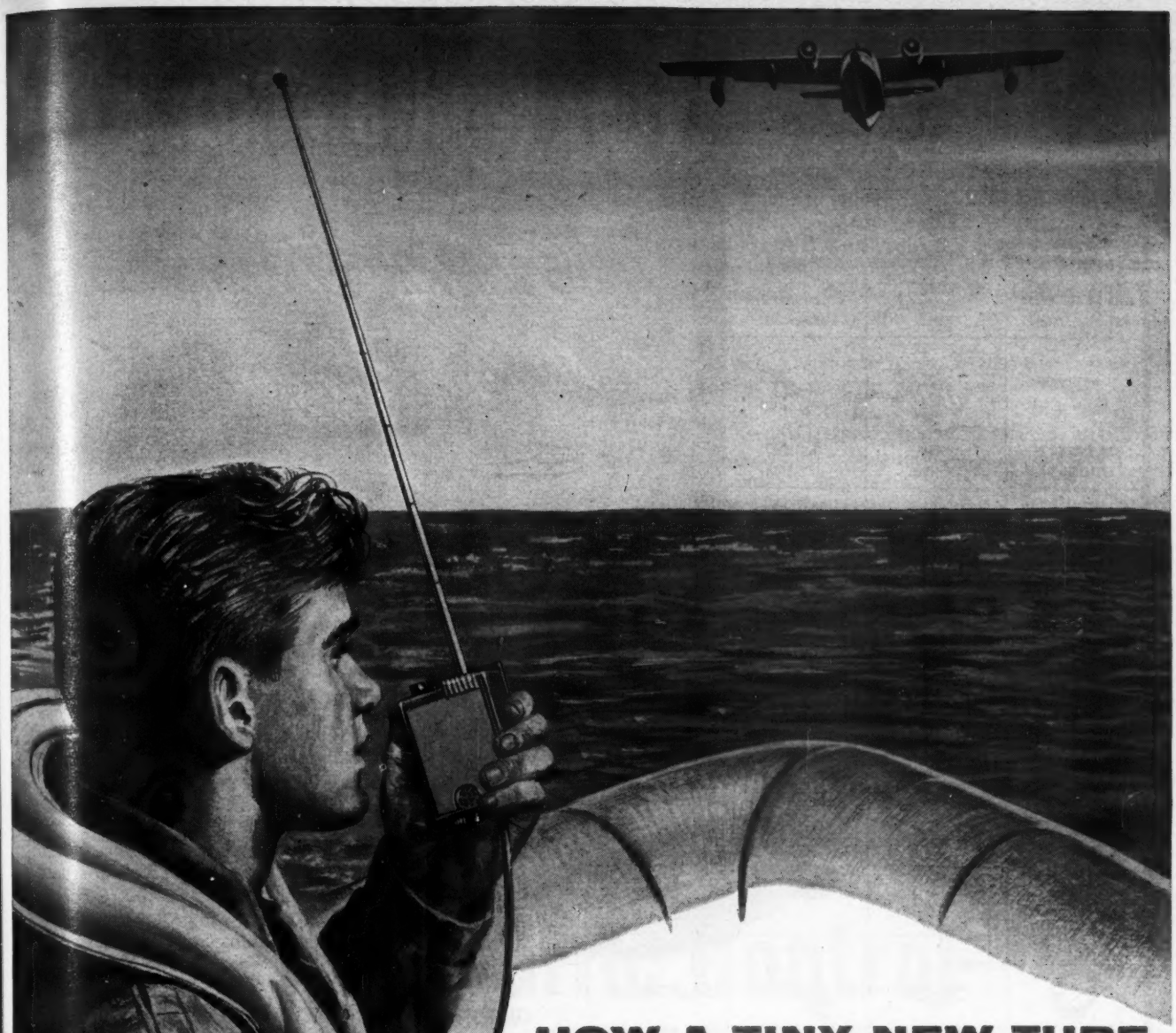
Second, hardness. This one is a little difficult to define in a few words. I would consider it a plant's ability to withstand an attack—its toughness. Marciano can take a haymaker better than I can; there are comparable reasons why some production facilities are tougher than others. Are their power sources self-contained or served by long, exposed power lines? Is the facility protected by hills or mountains? Are its component units spread out or concentrated? These are among the many factors that make up the element of hardness.

Third, flexibility. This embraces the facility's productive capacity. It includes the resourcefulness of equipment and personnel in the plant, the availability of additional labor, provisions for storing extra materials, and, in general, the ability of the plant and its people to take on added assignments or responsibilities, particularly under emergency conditions.

These are the objectives we seek in our industrial readiness policy. But it is important to keep these in their proper perspective. Our first interest is in getting the most Air Force for our dollar—an Air Force in being. We cannot afford to divert any important element of our resources from that goal under present circumstances.

We should recognize, however, that war might be forced upon us through a number of routes. It may be possible that the next global war would begin as a local

(Continued on page 111)



HOW A TINY NEW TUBE HELPS SAVE LIVES

The problem was major: it concerned human life. A pocket-sized waterproof "radio station" would help rescue downed aviators. The set was designed to send out a beacon signal and provide voice contact with search planes—but it lacked the necessary power output. Needed tubes did not exist.

Using its own resources, Raytheon developed a new subminiature tube—the 6147 and its improved version the 6397. Result: greater power, reliable operation, ranges over 50 miles, longer battery life.

Here is particularly dramatic proof of the skills which have made Raytheon the world's leading manufacturer of special purpose electron tubes.

Excellence in Electronics

RAYTHEON

RAYTHEON MANUFACTURING COMPANY

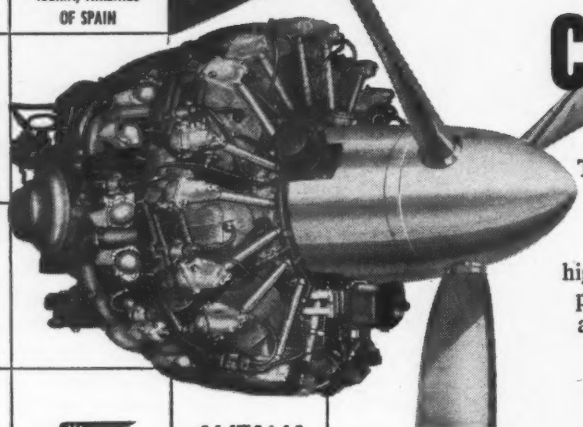
WALTHAM 54, MASSACHUSETTS

36 WORLD AIRLINES

SELECT THE

World's Finest Airline Engine

AIR FRANCE	AIR-INDIA INTERNATIONAL	AMERICAN AIRLINES	
AVIANCA COLOMBIAN NATIONAL AIRWAYS	BRANIFF INTERNATIONAL AIRWAYS	BRITISH OVERSEAS AIRWAYS CORP.	
CIA. CUBANA DE AVIACION, S.A.	DELTA AIR LINES	DEUTSCHE LUFTHANSA	
EASTERN AIR LINES	FLYING TIGER LINE	IBERIA, AIRLINES OF SPAIN	
K.L.M. ROYAL DUTCH AIRLINES	LINEA AEROPOSTAL VENEZOLANA		
MEXICANA DE AVIACION	NATIONAL AIRLINES		
NORTHWEST AIRLINES	PAKISTAN INTERNATIONAL AIRLINES	PANAIR DO BRASIL	ALITALIA ITALIAN INTERNATIONAL AIRLINES
PAN AMERICAN-GRACE AIRWAYS	PAN AMERICAN WORLD AIRWAYS SYSTEM	QANTAS EMPIRE AIRWAYS LTD.	CONTINENTAL AIR LINES
BELGIAN WORLD AIRLINES	SCANDINAVIAN AIRLINES SYSTEM	SEABOARD & WESTERN AIRLINES	SLICK AIRWAYS
SAA—SOUTH AFRICAN AIRWAYS	SWISS AIR LINES	TRANSPORTES AEREOS PORTUGUESES	THAI AIRWAYS COMPANY, LTD.
TRANS-CANADA AIR LINES	TRANS WORLD AIRLINES	UNITED AIR LINES	"VARIG" BRAZIL

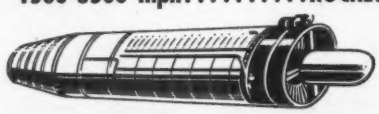


the TURBO COMPOUND

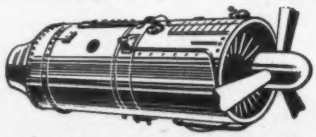
Such unanimous selection of the Turbo Compound for Super-Constellations and Douglas DC-7's is a tribute to Curtiss-Wright foresight in developing advanced power for high-speed, long-range economy. When present airline re-equipment programs are completed, over 100,000,000 seat miles per day will be flown in luxury transports powered by the Curtiss-Wright Turbo Compound.

CURTISS-WRIGHT PRODUCES POWER FOR EVERY AIRCRAFT SPEED AND PURPOSE:

1500-3500 mph.....ROCKETS & RAM JETS



800-1500 mph.....TURBOJET



500-800 mph....TURBOPROP

CURTISS-WRIGHT

CORPORATION • WOOD-RIDGE, N. J.

World's Finest Aircraft Engines

war and gradually spread out to larger proportions. If we are prepared, we may be able to take advantage of that warning period. We might even have time to build up, either to strengthen our forces for retaliatory action or, perhaps, if we act quickly and decisively enough we may cause the aggressor to back down from a threatened global assault.

I would like to say that, although this concept of the kind of war with which we may be confronted has sometimes been misunderstood, it is not the Air Force view that a future global war would necessarily have to be a short war.

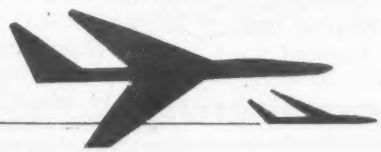
It is our view, however, that if the war ever spreads from a local peripheral situation to a general global situation, the first few days of the war will certainly be a very violent phase and probably the decisive phase of the war; and while we must emphasize the importance of this violent air battle, it is not part of this picture that the war will necessarily be ended and that we need no other resources beyond those required to fight this first phase. I just want to be sure that our position there is understood. We are confronted here by the fact that not only do we not have control of the way in which such a war may be initiated, but we do not have the timing of such a war and we have to be prepared for a variety of eventualities. This, of course, is a handicap.

At the same time, it seems to me if we continue to emphasize the overriding importance of our deterrent position, continue to emphasize that position as a position which seeks peace and which believes that global war should not and in fact must not occur, and if we keep the rest of our policies including, for example, this policy of plant dispersal and industrial readiness in line with this concept, we are meeting the main problem in its most essential form.

Finally, I would like to express for the Air Force, first, the recognition of the great dependence of the Air Force on its partnership with industry, science, and technology represented here in this room today. It is again an obvious thing to say that airpower is the combination of what you have done and are capable of doing and what the Air Force can do with the facilities that you gentlemen make possible for us and, of course, the resources which the Congress and the people are willing to devote to this cause.

It is a great pleasure for me to be here with you to pay tribute to the Air Force Association and the fine support that they give us in the Air Force.—END

the jet age



Air Traffic Control—Implications of SAGE

Dr. George E. Valley, Jr.
ASSOCIATE DIRECTOR, LINCOLN LABORATORIES, INC.

THE SAGE System is an undertaking by MIT which has primary responsibility to and support from the Air Force with also substantial support from the Army and Navy. The Lincoln contract has a very broad work statement. Essentially, Lincoln Laboratory shall do whatever research and development work is necessary to get this work into being. Under this work, the services have allowed me the broadest credence. I hope that events will prove it worthy. I can certainly testify to their courage. I would like to take this opportunity to express for myself and the Laboratory our respect and appreciation to the many military and civilian officials of the services for their support.

Now, there is a reason why this very broad-minded and generous approach on the part of the Air Force and the other two services has been necessary. We have in the SAGE System one of the most involved and complex problems ever set before anyone. Moreover, it is necessary to find the answer and to get the thing installed just as soon as possible in order that we should not be caught napping in another Pearl Harbor. Thus, the effort on SAGE is to get something very much larger and more complicated than has ever been attempted before done on an accelerated schedule. It has taken a great many people to get us this far. And it has been necessary to grant sufficient freedom to all of them so that if it were found that in some particular technical direction a wrong guess was made, the whole organization could turn on a dime and take another tack and find a different kind of a solution.

This has happened in a number of highly technical components of the SAGE System. The invention of the

(Continued on following page)

magnetic core memory by my colleague, Dr. Jay W. Forrester, is one example of this. In 1950 the existing electrostatic memories for digital computers were simply not reliable enough for military application. Lincoln Laboratory under Dr. Forrester's direction invented and developed these magnetic core memories expressly for SAGE. There have been other examples, in particular the still-classified devices which were invented by and developed under the supervision of John Harrington, and many others.

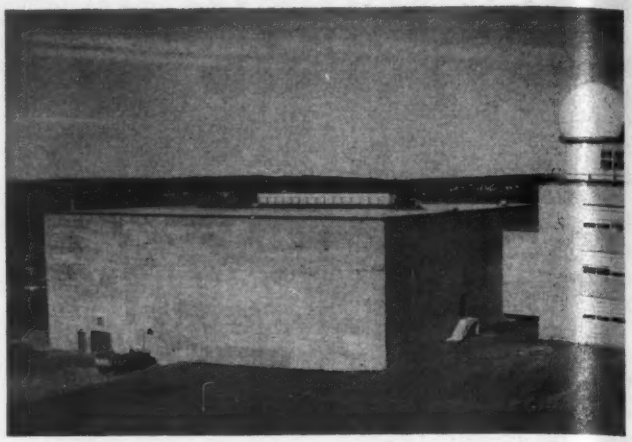
Now, I would not want you to get the impression that all of the SAGE System is done entirely in the Lincoln Laboratory. This would be far from the truth. In Lincoln Laboratory we do only those things in the SAGE System which it is essential that we do. But there are other organizations throughout the country who are far better fitted than either MIT or the Lincoln Laboratory to do other parts of the job. In particular, the engineering design and the fabrication and the maintenance of what is called the AN/FSQ-7 computing equipment is being done by the International Business Machines Corporation. Similarly, the Burroughs Corporation is making equipment which is to be located at some of the outlying stations of the SAGE System. The Bendix Radio and Hazeltine Companies are also operating as subcontractors.

DR. GEORGE E. VALLEY, JR., *Associate Director, Lincoln Laboratories, Massachusetts Institute of Technology. Born in New York City in 1913, Dr. Valley was graduated from MIT in 1936. He received his Ph.D. degree from the University of Rochester in 1939. After serving as a research assistant at Harvard he returned to MIT in 1941 and advanced to his present position. He received the President's Certificate of Merit in 1948. The Air Force Association's Science Award for 1951 was presented to him for his work on the SAGE air defense system.*

When the problem came of laying out the actual detailed communication channels and setting up the physical plants and doing all of the field engineering, the Air Force went to the Western Electric Company. The Western Electric, as you know, is the manufacturing adjunct of the American Telephone and Telegraph System; they have set up an organization called ADES. The Bell Telephone Laboratories advise the Western Electric Company and help Lincoln in the evaluation of the System. The RAND Corporation which works for the Air Force in certain consulting capacities is also working for them in a somewhat similar capacity on SAGE.

The Western Electric Company has the task of coordinating not only the manufacturers but also to some extent the efforts of the Lincoln Laboratory. In other directions, the Lincoln Laboratory does the coordinating role and in still other ways, as pertinent, the manufacturing organizations do the coordinating. This kind of complex organizational structure cannot function on the basis of contracts alone. It works because everyone involved wants to get the job done and because we have the fullest of support from the armed services and, in particular, from General Putt and the Air Research and Development Command.

The Lincoln Laboratory, broad as its directive is, still does not primarily direct its work toward traffic control. Our business is air defense. We are not now working on the problem of air traffic control although we have to work very closely with the local civic authorities, so we are familiar with the problems.



AN/FSQ-7 Air Defense Computer is housed in this building of the Massachusetts Institute of Technology Lincoln Laboratory, Lexington, Mass. This vital part of SAGE, produced by IBM, is first computer designed for air defense.

I would like to discuss and compare different functions of the ground environment for air defense and of a similar hypothetical ground environment for air traffic control.

The first function is that of gathering information. The information as to where aircraft are located in the air must be provided either by radar sets or by transponders. There is very little difference between the two problems except possibly the deployment of the ground stations which might be changed somewhat from one problem to the other. This, however, is a matter which would require special and detailed study to state for certain.

A great deal of other information is required with respect to flash plans, and so on. This need is approximately the same for the two problems except with air traffic control one would want to have on-the-spot information as to when a particular flight will get its wheels off the ground, etc.

You use the data in order to enable people to make decisions, and in spite of the fact that a good deal of automatic machinery is in use, people do make all of the decisions, and this is essentially the same for both systems.

The decisions which have to be made, of course, are different. But this, I think, indicates little about the technical construction of the devices. One may play martial music on the same piano which plays the Third Hungarian Rhapsody. It is only a question of how you train the pianist. So, the problem of surveillance, although it is the largest portion of the job which a ground environment system has to do, is very similar for the two problems. For the peacetime job and the military job, it consists essentially of finding out what is going on and deciding what to do. The fact that the decisions are different does not affect the operation; it only affects the people and their training and their intentions.

The second half of the job is the control part of it. Now, again, what is control? It is not airplanes, but pilots, and what is doing the controlling is not a machine but a man.

The technical side of the problem is very different in the sense that the effort of the military is essentially to cause collisions, to make a weapon collide with an enemy airplane. The effort on the part of the civil services will be to prevent collisions. However, the kinds of computations and logical processes which need to be worked out are mathematically and logically very similar. I think the way in which the air traffic control problem would be

(Continued on page 114)

CHOU FOO LING

was born too soon...

Back in 1237 AD the inventive Chinese saw the potential of Rockets as a source of power.. attempted to gain extra acceleration by attaching rockets to their sleds.

he was seeking "Superperformance"

Alas, Chou Foo Ling's experiment was a dud, even though he had the right type of power-source for superperformance.

Today, Mr. Jet Pilot can have extra power—reliable rocket power—at his fingertips, thanks to recent important technical achievements at Reaction Motors. He can turn his RMI rocket auxiliaries off or on at will for steeper and faster climbs, higher operational altitudes, or greater maneuverability and speed.

At RMI's new modern plant, an integrated team of rocket specialists are putting the "super" in today's aircraft performance... constantly conquering the frontier of speed and space.

Spearheading Progress through Research

RMI

Career opportunities available for experienced mechanical, aeronautical, electrical and chemical engineers, physicists, chemists. Send complete resume to employment manager.

REACTION MOTORS, INC.
Denville, New Jersey
Affiliated with OLIN MATHIESON CHEMICAL CORP.

Part of SAGE radar. System makes detailed information about enemy air attacks available to defense personnel.

done would be to forecast for some fixed and agreed length of time a trajectory of each airplane, perhaps five or ten minutes into the future, then inspect for possible interceptions, then transmit orders to the airplanes concerned.

Although the orders to the military aircraft will go by code, it is not necessary that we should do so and, indeed, voice has been used. The number of voice channels which are required for this kind of a problem depend on the amount of orders that are going to be transmitted in a given interval of time. The number required for the civilian job will depend on how closely and in how much detail particular single airplanes are to be ordered.

It is not our job at MIT to express an opinion as to whether the SAGE System should be used for air traffic control. Personally, as an individual, I think it should be. In fact, I think it will be, but we should make plans which involve many things besides technical considerations so that SAGE will be used effectively and as soon as possible. In order to do this, such non-technical subjects as the methods of enforcing air traffic legislation—that is, how you must set up speed cops of the air—will have to be worked out. In the Lincoln Laboratory, we can only point to the technical possibilities and consider whether or not we could be useful in helping to solve them if we were asked.

Henry Simmons [*American Aviation Daily*]: Could you estimate the cost of supplementing SAGE to handle air traffic control and also could you say whether SAGE could ever be used to control aircraft directly, rather than the pilots, through automatic pilot systems?

Dr. Valley: The cost would be small but a significant fraction of the total cost would involve the installation of the system. One has to study the problem very carefully to find out what you want to do. One has to study the changes in these operations and get them accepted. While these things do not themselves involve hardware, nevertheless they do involve a good deal of expense. More expensive, perhaps, would be the cost of putting terminal facilities in places where the Air Defense Command would not need them, for instance, at Idlewild Airport where one would need to have sources of data with respect to what the aircraft are doing at the field. One would need presumably to have receiving devices from the direction centers in order to have a man at the airfield who will know what is going on and what to expect will come in. However, we cannot really say with any certainty now what this amounts to until it is decided how close the air direction centers or the Air Defense Command are to be physically separated from those of the Civil Aeronautics Authority and precisely what is the job that wants to be done. I think that the procedures, the operational procedures, are likely to be considerably different when you use SAGE when compared to what they are now. Not only do you want to facilitate handling such complicated situations, but it occurs to me that, if possible, one would try to prevent such complicated situations from taking place.

I would prefer not to answer the second part of your question.

From the floor: Has CAA shown an interest in SAGE and, if so, is the information available to them?

Dr. Valley: Mr. Joe Blatt and his associates and some members, I believe, of the Air Transport Association have been to Lincoln several times. They have shown an interest and, as far as I know, a great many of them are completely cleared and they have all of the information that we have that is available to them. The Lincoln Laboratory, however, is not working on the problems of air traffic.

Display consoles of the Whirlwind I. This digital computer is one of the highest performing in existence and can quickly process large quantities of air defense data.

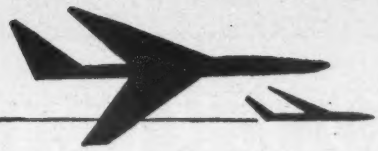
From the floor: I am a city commissioner from a city which is fortunate enough to own an airfield near a SAGE installation which is under construction. We have both jets and private commercial traffic from that field. Will SAGE be of any assistance to us in promoting air safety?

Dr. Valley: SAGE is an instrument and will not in itself promote anything. The problem is one of men in their relationships with other men. The SAGE system is a tool, a modern tool which they can use to take care of modern problems, but that is all it is, and it is we who have to solve the problem that you bring up.

John A. Mack [Vice-Commander, New York Wing of AFA]: Assuming commercial carriers do use SAGE and it is developed for traffic control, would not the cost be prohibitive for the private flyer?

Dr. Valley: As far as I can see now, it is not necessary for any apparatus to be installed in the airplane other than the radio set, which I imagine the private flyer would have already. I cannot guarantee that, but that is the way it looks to me today.—END

the jet age



Controlling Traffic on Our Crowded Airways

A FORUM

The AFA Air Traffic Control Forum was moderated by James H. Doolittle. Panel members included Col. J. Francis Taylor, Jr., Dir., Air Navigation Development Board; James T. Pyle, Special Ass't for Aviation to the Ass't Sec'y of the Navy for Air; Clarence N. Sayen, Pres., Air Line Pilots Ass'n, Internat'l; Leighton Collins, Editor, Air Facts; *C. F. Timmerman, Dir., Air Navigation Traffic Control, Air Transport Ass'n; Col. L. S. Lightner, Chief, Air Traffic Branch, DCS/O, USAF; Crocker Snow, Dir., Massachusetts Aeronautics Commission; and David D. Thomas, Deputy Dir., Office of Federal Airways, CAA. Since, as with the Noise Abatement Forum, there were no prepared texts, minor editorial liberties have necessarily been taken.—The Editors.*

MR. COLLINS: I would like to describe just who the private pilot of today might be. He is really two people. On the one hand, he is your Sunday flyer and hobby flyer. The private flyers of this country own some 25,000 airplanes, mostly two-place airplanes; they are often poor and frustrated. Yet flying is still very much in the spirit of this man, and we are greatly indebted to him for his contagious enthusiasm. In fact, without his business our many thousands of small airports could not exist. The private flyer is also a business and professional man. He acquires a twin-engine airplane, which he may attach to his own business or that of his employer as a plane for private transportation. The key point is that it is incumbent upon the private flyer to make his airplane justify itself economically.

Any traffic control system which, through red tape or expensive and heavy airborne equipment, would nullify the economic advantages of the private airplane, would destroy our private air transportation industry. It is booming today as never before and it is only getting started. It contributes importantly to national defense, because, in the expedition of business, it makes us a more productive nation. We must be mindful, too, of Title I, Section 3 of the CAA Act which says that it is hereby recognized and declared to exist with any citizen in the United States a public right of freedom of transportation and of navigational commerce in the airspace in the United States. It is a good law and I think it means that the private flyer must be included in the eventual solution of the airspace problem.

Mr. Pyle: I think it was Gen. [Milton] Arnold who mentioned that we have to invent a new system, and I thoroughly believe in that approach to the problem. However, I do not want to think of it in terms of a new navigation aid. It is a systems approach that we have to make.

The second point is this question of positive control. We should think of it, not in terms of control as positive separation, but as a system that will not impose any undue penalty on any user of the airspace. You have to be sure that all of the users of the airspace receive equal consideration so that their demands are met. They have a right to use the airspace with the least penalty. I think we can work at it jointly and arrive at such a positive system of control. I do not mean IFR as we know it today. That would just swamp the CAA and they could not handle it.

Another point is the high-altitude problem which has been referred to. I feel it is a great step forward that CAA is going ahead with control of flights above 24,000 feet. As you probably know, 1,000 on top clearances are the order of the day for the jet pilot. You are on your own, and you keep your eyes open in case somebody else is up there with you. It is not good, and it is highly dangerous. I think the CAA is to be commended in facing up to the problem.

The last point, again, is a common problem. We have an educational problem in this country. We have to educate people to this question of traffic control. I am speaking now in terms of not only the positive control study in which we would all participate—civil, general, military aviation, and so forth—but we are equally responsible for informing the people who hold the purse strings what they need to provide in terms of funds—I am speaking of members of Congress and the Bureau of Budget.

Mr. Timmerman: As an old traffic control man, I have been worrying about this situation for about nineteen years now, and it has been a pretty frustrating experience. We have always had the demand for a better system. Yet, we have never achieved this. However, I think there has been manifested here a wide understanding among all interested people that this subject is serious and must be solved, and I now feel that we are in the atmosphere in which we can do it.

Colonel Lightner: I think it is evident to all that, from what has been said here at this conference, the Air Force must have the wherewithal to do the job that has been given to it.

Mr. Lederer pointed out that we cannot accept the possibility of any aerial disasters which are in the slightest way comparable to what has been happening on our highways.

We now know and have known for some time that we have inadequate air traffic control systems. We know that we have to take some big jumps to catch up. We also know that we have the technical know-how and we have the brains and the means to improve this situation.

Mr. Snow: I have two very quick comments. We of the states heartily endorse what Messrs. Pyle and Collins have said about accommodating all users, agricultural users, any flyers involved.

(Continued on following page)

The other one might be a slight curve. I think what we all mean when we say air traffic control is the system that is designed to expedite the flow of air traffic and, at the same time, minimize the chances of interception or collision. Anyone who drives an automobile or who runs a railroad or drives an outboard motor boat has experienced another sort of traffic control, and that is the control that is designed to protect the person who is not driving. There is hardly a state in the United States that does not require a driver to slow down when he is passing a school. There are many states which also require mufflers and silencing devices when an automobile is being driven in their particular area. I believe we are coming to the time when we have to consider in this traffic problem not just the people in the airplanes but also the airplanes on the ground.

General Doolittle: How can we measure the present air traffic control capabilities against the present air traffic control requirement for the safe, orderly, and expeditious movement of aircraft? I interpret that to mean, how can we measure the adequacy or inadequacy of the present system and, having measured it, what will that measurement show us about the adequacies or inadequacies?

Mr. Thomas: I would like to state first, before we attempt to measure what it is actually doing, during this hour that the panel is in session—just an average hour in any day or night—we will be controlling about 2,200 landings and take-offs. Right now, there are about 500 aircraft in the air under instrument conditions and about 1,400 under VFR conditions. Some of the airports are quite busy. At Chicago, for instance, there is a landing and take-off every eighty-two seconds every day and every night.

This system, as inadequate as it is, is handling more traffic than has ever been known before, and the traffic is increasing. One measure of its inadequacy under instrument flight rule conditions might be how much of the time is it impossible to get into the system or how often is one restricted by that fact. At present, restriction, or full control, is in effect about twelve and a half percent of the time.

Another measure of the system might be how many people fly daily under visual flight rule (VFR) conditions and who would fly under instrument flight rule (IFR) conditions or bad weather if the total system permitted. Right now, there are about 2,800 flights a day under VFR conditions, other than local flights around the airport. We are handling now around 10,000 to 12,000 IFR flights around the airport. Many VFR flights would never fly far regardless of the system, and our best guess is that the capacity should be raised for IFR only 25 percent, to 50 percent.

Mr. Timmerman: I could just add that the measurement of the demand as contrasted with capacity, I think, is somewhat difficult to do. The CAA has kept records on delays ever since the beginning of traffic control, but they just cannot get all of the information that is required. For instance, they do not know about the military commander who defers his missions because of the inadequacy of the system in many cases. They do not know when a scheduled airline flight is canceled because the airplane that would be used for this purpose has been caught in a traffic jam.

In recognition of this problem, the scheduled airlines, through the Air Transport Association and with the complete blessing and cooperation and participation, I might say, of the Civil Aeronautics Administration, only about ten days ago launched a nationwide survey to measure this delay situation and the cancellations that are caused, and so forth. This survey is being done through a standard sampling technique, so we feel it will be somewhat representative of all flying, although the reports will only pertain to airline schedules. It will attempt to isolate the schedules, causes and frequency of the delays, etc.

Mr. Pyle: I would like to make one point with respect to this high-altitude problem. I do not mean this in any spirit of criticism, but the flight plans that are flying over the military flight service organization indicate that over 50 percent of the military IFR flight plans are for altitudes in excess of 20,000 feet. I would not say the number of flight plans in volume, but you can measure what volume of traffic there is above 25,000 feet. About sixty-five percent of those flight plans are either on direct point-to-point or just point-to-point.

General Doolittle: Short of a new system, to what extent can air traffic control be improved through refinements in present procedures and equipment?

Mr. Sayen: I am convinced that there are quite a number of things that could be started now and probably should have been started three or four years ago which would greatly improve the air traffic control system. I think we have no alternative but to increase the capacity because it is the only system we have at present, and we cannot stop our aircraft control. What can we do right now? First, I think we have to accept three basic concepts and then go from there.

The first one is the fact that the "see-and-be-seen" philosophy is obsolete. In a meeting of the airline pilots of twenty-two countries in 1954, it was unanimously concluded that the see-and-be-seen theory was obsolete; that if it were going to be used as the basis for any procedures for traffic control, then some method had to be devised to help the pilot locate traffic.

The second thing is this: We might as well recognize that the span of attention of the human being, no matter how intelligent or resourceful, does not exceed or does not extend to flight times, and if we convince ourselves that the pilot can sit on the edge of his seat for seven or eight hours and look at nothing and identify other aircraft, we are just deceiving ourselves.

Also, we have to concede that the airway begins at the ramp and ends at the ramp, so the airport is part of the airway and has to be part of the aircraft control picture. The capacity of the airways system is limited by the capacity of the airport. You cannot handle more traffic than the airport can accept or can put out, so you have to orient the airport into the traffic system and build it into the traffic system.

Additionally, I think we have to accept the concept that there must be one single agency to control all air traffic, and that agency has to assert itself and accept the job of providing air traffic control.

Now, by accepting those premises, what can we do right now? One, we can build better airports and orient them into the airways system. We can build longer runways for all-weather operations. We can install on those runways lighting for which standards have already been agreed upon and have been agreed upon for a number of years. We can put in multiple runways so that you can increase the acceptance rate of aircraft. We can run as many as ninety aircraft movements an hour on airports with multiple runways using the present air traffic control system if you have an adequate multiple runway system. With those runways, we need adequate approach lights. We have an agreed-upon standard and we have appropriations. We need several approach light systems in each airport in different directions so you are able

(Continued on page 119)

WONDER DRUG
for aircraft headaches

℞

DIRECTIONS:
Take whenever fuel control or fuel systems problems need a better solution.

CONTAINS:
A balanced formula of Engineering, Research and Development, Precision Manufacturing, and Complete Testing Facilities...plus liberal amounts of Experience and Creative Imagination.

WARNING:
Is usually habit forming...
a very very good habit too.

CECO Handler-Evans

CHARTER OAK BOULEVARD, WEST HARTFORD, CONN.

Pioneer Producers of

JET ENGINE FUEL CONTROLS • AFTERBURNER CONTROLS • PUMPS • SERVOMECHANISMS • CARBURETORS • PROTEK-PLUGS

Solar builds world's largest wind tunnel bellows

GIANT BELLOWS that absorb the supersonic stresses of wind tunnels are a Solar specialty. Solar builds them—in sizes greater than 25 ft in diameter—for many government and private test facilities. These Sola-Flex joints exemplify Solar's increasingly diversified services for the aircraft industry. For more information, write Dept. B-122, Solar Aircraft Company, San Diego 12, Calif.

SOLAR
AIRCRAFT COMPANY

SOLAR
SAN DIEGO DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF BELLOWS • GAS TURBINES • METAL ALLOY PRODUCTS • CONTROLS • HIGH TEMPERATURE COATINGS • AIRCRAFT COMPONENTS

to use them for all-weather operations.

We need multiple installations which are available at airports so we can land on more than one runway and thus increase the acceptance.

In the field of personnel, we need some system for maintaining our experienced personnel in tower control work and aircraft control work. We are losing our experienced personnel at a tragic rate. We are doing it because, in some cases, there is no system established in the salary classification to attract the most experienced people to the heavier areas. A traffic controller can make just as much in a limited density area as a controller in a heavy area. We have only been able to keep some of our high-density areas running because we had a high degree of experience and technique and very close relationships between controllers and pilots. We can cut down the turnover in personnel by reviewing the personnel policies and the salary policies, and that draws in many agencies of government, including the Civil Service Commission. We can start aiming toward all-weather operations. To do that, we have to improve our meteorological methods. We are going to have to go in for slant visibility methods. We will have to go for lower minimums. Some of these things can be done at the present time. We have to accept the fact that we are going to have to have positive control of all traffic aspects as presently available equipment can be installed. Terminal area radar and route radar and such equipment has been developed and is available, and it merely needs to be installed. It should be installed rapidly and immediately rather than installing it five, six, or seven years from now. By so doing, we could greatly increase the present capabilities of our system.

If we can develop an aid to the pilot—and this, of course, is the ideal solution—if we could put the control in the cockpit with some aid to the pilot by which he could be his own controller, we could start the see-and-be-seen principle. All of these things require money to get started. Some of them have been programmed for the next five years. I believe that if a program were installed in the next five years, maybe we should accelerate that program and try to install them in the next two years, and then pay for them over the next five years. We need that badly to meet our present capacity.

The question, then, is where does the money come from? In my view, there has been a sufficient national recognition of the emergency situation that exists here as demonstrated by this excellent meeting; that there has been an acceptance on a national basis that this problem has to be solved and that, therefore, the funds may not be a very serious problem. This may be a case where the politicians are ahead of the technicians.

Mr. Pyle: In the first place, I think the radar problem is a must. However, we have to think in terms—and I know that the CAA has done so—of cutting through rain and snow via radar. The radar looks nice and pretty but when you really need it, you cannot see what you want to see with it. That problem will be solved by putting in new equipment.

On our surveillance, short-range radars, I think we have reached the ceiling. Jet penetration starts at 20,000 feet. Some of our radars on which we depend for approach control only pick that plane up at 12,000 feet. At that point, he is coming down at about 6,000 feet a minute. It is a pretty rough deal to pick him up and vector him around. We have to look at the communications problem. Direct pilot to controller communications links must be considered. I think that would solve some juggling of frequencies. I presume a lot of you have read "Ace" Rosen's comments in the January 30 issue of *Aviation Week*, in which he points out that in a flight of one hour and fifty minutes, he made thirty-three different communication contacts on thirteen different frequencies. I don't see how a guy has a chance to fly. He is a communicator.

I think we also have to look at the radar safety people. Consideration must also be given to the radar picture to reinforce the echo to assist traffic control, not only in terms of that point but also identification.

Lastly, I think we have to help the controller; we have to give him better display techniques. The stripboard technique cannot take care of the requirements of the modern traffic control system. Whether it be pictorial display, an electronics display or what, you have to lick it.

Colonel Taylor: The remarks about radar are certainly well taken as far as precipitation, static, and noise are concerned, but a recent development, of which the CAA is well aware and for which they are budgeting, is circular polarization which will improve the signal to noise ratio of twelve decibels.

We must make more use of the air defense radars that are on the ground and turning, examine each of these radars in terms of its benefits to the air traffic control situation.

Mr. Snow: We have wondered whether some portion of this admittedly vanishing airspace is not being wasted right now. As you all know, the control airways extend several hundred feet above the ground. Below that, the air is free for the small airplane. There are very few IFR flights cross-country that approach that altitude. We wonder if that altitude, if it were raised substantially to a 1,000, 1,200, or 1,500 feet without affecting en route traffic at all but providing considerably more useful airspace for the small, low-flying aircraft under restricted visibility would be helpful.

I would like to argue slightly with Clarence Sayen about two of his recommendations. One is that the see-and-be-seen philosophy is extinct and that there must be positive control of all air traffic as soon as it exists. I do not think we can argue that about military or jet aircraft, but we do not believe it emphatically in connection with agricultural aviation, certain types of private flying, and that type of thing. I want to know if he intended to include all flying or a particular type of flying.

Mr. Sayen: I am referring primarily to en route operations of transports. I think the see-and-be-seen philosophy would reduce the speeds of slow aircraft flying at low altitudes.

General Doolittle: What is the estimated air traffic control requirement for 1960? That could be interpreted, I think, two ways. It could be interpreted as what type and how many aircraft must be handled or what will we need in the way of equipment to handle the traffic that we will have in 1960.

Mr. Thomas: All of our studies indicate that in the next four years, the traffic increases in the things that count—traffic control and operation of instrument approaches — will increase about seventy-five percent. That means we must double the capacity required today by 1960 if we handle air traffic under the same rules today.

If we adopt the concept of handling all traffic under positive control, we would need about a sixfold increase in our capacity to do that in the next four years.

Briefly, in answering the question with respect to equipment, we very well agree that it should be automatic. However, until we have automatic equipment available, we will use present manual methods, and we expect an introduction of the automatic

(Continued on following page)

systems by about that time and not much before, so we have a lot of rough manual work ahead of us for the next two or three years anyway.

Mr. Timmerman: Surely we have to control some high-operation type traffic under all-weather conditions. With that in mind, I would like to point out that in spite of the deficiency of our traffic control system, there is considerable capacity in the system today that is not being used, primarily during the VFR situation. Even under instrument conditions, there is some unused capacity in certain areas where the density is not high. This, too, can be used, so the problem of controlling most of the traffic in the system is not quite as bad as it may appear at the outset. I think Dave is a little pessimistic in saying it would take six times the value. I think it would be more on the order of half that.

General Doolittle: What steps are being taken or contemplated to meet this future requirement?

Colonel Lightner: First of all, General, we have the CAA five-year plan, which is a proposal to increase the capacity of the present system. It has such features as expanded use of radar over most of the continental US. There is also direct pilot to controller communications. It is a good plan but what it does is increase the capacity of the present system.

Some big jumps are required here in the way of going to automation, automatic methods. If we do not do this, as soon as we are capable of doing it, all we are doing is keeping a system that is doomed to be behind us as we increase our speeds.

To increase the capacity of the system, we have to basically reduce separation standards. Those Air Navigation Control criteria, that block of airspace that is built around the aircraft that is operating under instrument conditions, under controls—he has a block of airspace built around him which is vertical, longitudinal, and latitudinal. We know the type of aircraft that we are faced with operating, and the question that bothers us right now is that the Air Navigation Control criteria for separation standards, which were developed back at the first part of World War II, look like they are going to be outdated immediately. The speeds of the aircraft that we are operating are taking up a lot more airspace than that which was set aside for holding the patterns, procedure patterns, and straight en route climbs. It is this block of airspace that we have to cut down. In order to cut it down, we have to have such things as more accurate navigation aids. We have to give the controller at the terminal area the ability to see that aircraft, to positively put him in a definite position.

We can use radar immediately to help see, to help the controller see where the aircraft is. It is true that there are deficiencies to radar, but at least radar will help the controller to get out of tight situations, situations which he cannot even see now.

I would like to point out, too, the importance of communications to traffic control. This is the glue that holds the system together, and without adequate communications, the controller is never able to do the job that he should be capable of doing. It has often been said that a controller's job is ninety percent coordination and ten percent controlling, and this is largely true. Communications both air-to-ground and point-to-point on the ground is what really makes the controller able to do his job.

General Doolittle: What will be the capacity of the CAA air traffic control system after implementation of CAA's proposed five-year plan and how does this compare with the capacity of SAGE?

Mr. Thomas: The capacity of the system after the implementation of the five-year plan will be roughly four to one of the present capacity. That will be realized, however, only if we have the adequate communications, navigation and airports to permit the aircraft to utilize that much higher capacity that we will have.

The second part of your question is what will be the capacity of SAGE? I do not think that I can answer that. We are not in the process of studying that, to my knowledge, and as stated by Dr. Valley, the SAGE people have not studied the traffic control problem.

I do want to say that whatever capacity SAGE has, all elements that make up the total system such as navigation, communications, and airports, have to come along with it or any capacity may be theoretical and never realized.

Colonel Taylor: I would like to ask Dave a question about communications. Do you believe it is possible to expand the present system in this four-to-one-ratio you mentioned and still have the same type of communications? What if we get to the point where we cannot expand communication?

Mr. Thomas: I think it is quite obvious that the present communications systems—airborne and ground—could not handle a four-to-one communications workload. We have to have some other communications system with multiple division of frequencies. Just where we are going with the data link, I am not sure, but communications are the bottleneck.

General Doolittle: Can SAGE be extended in scope to provide a semi-automatic air traffic control system?

Mr. Taylor: I think it can because I am a great believer in potential, but I would like to point out that in Dr. Valley's discussion of this matter, he emphasized that Lincoln was doing no work on traffic control.

Dr. Valley has attacked this problem with the same type of intelligence that a man would have to have who invented the SAGE system. He alone knows what reservation he has. I know that SAGE is not going to solve automatically any traffic control problem that we throw at it today.

Colonel Lightner: General Bergquist pointed out that SAGE is a system that is set up to do an air defense job. The information that is gathered from the radars and other means in the SAGE system is important and can be used for traffic control. He also pointed out, as did Dr. Valley, that the computer is not set up to do the problem-solving function of air traffic control. It is set up to do the problem-solving function of air defense. Whether it can do an additional job depends on the size of the computer, what can be put in it, and so forth. We do not know at this point; we have to get with it and take a look at it—and the sooner the better.

Mr. Thomas: I do not know that it is clear that one of the most urgent things confronting the government is a project under Colonel Taylor, with both the Air Force and the CAA participating. This project is a study of SAGE with a view toward its utmost use and to gain everything we can from it from the air traffic control viewpoint.

Mr. Pyle: I think Mr. Thomas put his finger on it. There is a study in process, and I think the big problem is to get on with that study and get it done just as quickly as possible.

General Doolittle: Would congestion be relieved by a system of principal airways for jet traffic and a secondary traffic system for small aircraft and slow conventional commercial carriers?

Mr. Snow: We wondered whether in terminal areas the present concept of horizontally separated airways may not already be obsolete and whether

(Continued on page 123)

Another Antarctic Expedition calls on COLLINS for communication

U.S. Navy Task Force 43 is establishing several bases in Antarctica in conjunction with the International Geophysical Year activities. Two bases will be built next year, one of them at the South Pole. The expedition, appropriately entitled "Operation Deepfreeze," is under the direction of Rear Admiral Richard E. Byrd and commanded by Rear Admiral George Dufek. For radio contact between bases and the outside world, the commercial and amateur communication equipment will be Collins.

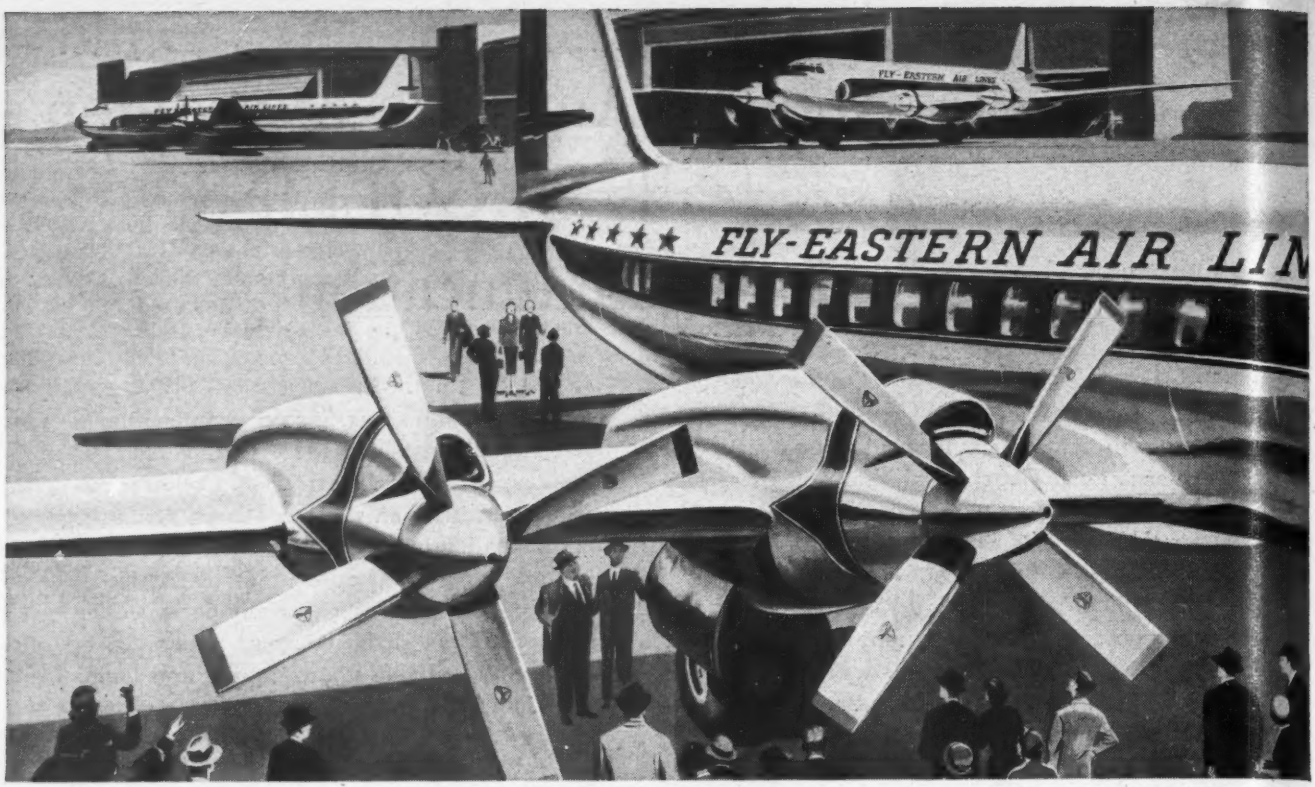
The name Collins has figured prominently in polar expeditions since 1925. During Admiral Byrd's expedition of the early 30's, Collins transmitters were used in the first Arctic/Antarctic communication link—from the Byrd Expedition (Antarctic) to a CBS station in Northern Alaska. The Collins equipment is specially packaged for air drop and long sledge journeys. Superior performance and reliability, proven time and again, make Collins the logical choice when the need for radio communication is vital.

Collins CREATIVE LEADERSHIP IN ELECTRONICS

COLLINS

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA; WASHINGTON, D. C.; DALLAS; BURBANK; NEW ... COLLINS RADIO COMPANY OF CANADA, LTD.; OTTAWA; COLLINS RADIO COMPANY O... LTD., LONDON



World's fastest, smoothest, most luxurious airliners, the new Lockheed Electras with Allison Prop-Jet power will enter service on Eastern Air Lines routes in the Fall of 1958

Capt. Eddie Rickenbacker
Chairman of the Board
EASTERN AIR LINES

Captain Eddie Rickenbacker chooses

Aeroproducts Propellers *for* Eastern Air Lines'

new fleet of Lockheed Prop-Jet Electras

A balance between engine and propeller is necessary for efficient aircraft performance. It is absolutely essential in the new high-powered Prop-Jet airliners whose propeller tips will spin at velocities of 600 feet per second.

That is why Captain Eddie Rickenbacker, dean of the air transportation industry, has chosen Aeroproducts Propellers with Allison turbine engines for Eastern Air Lines' great new fleet of 40 Lockheed Electras.

This proved engine and propeller team, designed and built by General Motors, will enable Eastern's new 66-passenger radar-equipped luxury liners to fly at speeds of over 400 miles an hour—bringing unprecedented new standards of smoothness and comfort to air travel.

The 4-bladed Aeroproducts Propeller was selected because it utilizes most efficiently the vast power of the Allison turbine engine, and because it combines rugged yet lightweight strength with unique features of pitch control and dependability unmatched by any other propeller.

Eastern Air Lines, serving more United States cities than any other airline, has earned and held the confidence of the traveling public for over 28 years. We of Aeroproducts are highly gratified by Eastern's choice and consider it an outstanding endorsement for Aeroproducts Propellers in this new era of turbine air travel.

The Allison Prop-Jet engine with Aeroproducts Propeller is the world's most advanced propeller-type aircraft power — both certificated by the Civil Aeronautics Administration for commercial service.

Building for today...Designing for tomorrow

Aeroproducts

ALLISON DIVISION OF GENERAL MOTORS • DAYTON, OHIO

the question can be approached on the vertical basis more effectively.

It seems to us that we are going to have to have positive speed control and that possibly the speed would increase as the airway got higher. It is obvious that that block of air that Colonel Lightner spoke of can be materially reduced if all of the planes on an airway might be vertically separated for traveling substantially at the same rate of speed. In the terminal area, we feel very strongly that separate airways would help the situation, and they would not be what we consider the normal airways now. But it seems quite inefficient in the use of air to bring in a B-47 or a Superconstellation in the same final approach and landing pattern that you bring in even a DC-3 or something slower. It seems to me we must develop separate landing paths or at least let-down areas in accordance with the speeds of the airplanes.

General Doolittle: What are the prospects for an air traffic control system suitable for helicopters?

Mr. Snow: Frankly, I do not know. There are two things that are apparent to us. One is that we have to think in terms of more vehicles than helicopters. We feel that by the time this will become a serious problem we will have other types of airplanes that will be able to operate in substantially the same way as helicopters and possibly more efficiently, so the first thing we would like to do is not tie this to the rotary-wing aircraft.

Secondly, from our experience with slow-flying aircraft, we do not feel that the present systems which we have nowadays, such as the VOR/DME, are satisfactory for this type of control, because they just will not work any distance from their source at the low altitude where we feel this traffic should operate.

Our quick answer is that from what we see in the equipment now available, we do not think the prospects are very good.

Colonel Taylor: I have one or two statements, General. We are completing the navigation aids for helicopters. In the New York area, this will mean a system developed in England and now being manufactured in this country, known as Decco, which will complete the test work in this particular field. If we can take the word of Mr. Block of New York Airways, the main problem in helicopter traffic control is for the helicopter pilot to know where he is all the time.

In the future, when we get a system that is truly common, it will have to include the helicopter. This is fifteen or twenty years ahead, I am afraid.

From the numbers point of view, we are in trouble already. Jim Pyle asked me to point out a fact that is known to a great many of us, but perhaps not generally known. Already, the New York Airways is the second largest operator at LaGuardia Field in terms of numbers of take-offs and landings—they are second only to American Airlines.

General Doolittle: What would be the effect of a completely automatic air traffic control system on (a) military flights, (b) commercial flights, and (c) private flights?

Colonel Taylor: I was afraid of that one.

About eight years ago, we produced an aircraft that would travel completely automatically if you told it in advance where it was supposed to go. This was a military aircraft designed for military operation. This lent itself, we thought, quite admirably to an air traffic control situation where messages could be sent to the aircraft from ground-derived data and perhaps some of the air-derived data that the aircraft could send to it. I think from the military point of view this might be one of the final answers.

From the standpoint of commercial flights, this is quite a way off, in my estimation. I am well acquainted with a great number of commercial pilots who fly for the scheduled air industry. They are proud of their responsibilities and capabilities. I do not think that they would want to have their manual operations taken away from them. This, again, is something so far in the future that I hesitate to say what the potential is. Certainly, though, some semblance of automatic flight will probably have to be adopted if we are to reach the traffic numbers that we seem to be wanting today.

As far as the private pilot today is concerned, I think we are in a matter of economy, and the amount of money that the private pilot can spend. The private pilot quite naturally prefers the concept of operation that is called see-and-be-seen. He wants to fly his own aircraft. Since the paying passengers or the military are not buying his equipment, he is going to have to struggle along the best way he can with his own money. Flying with him is as much pleasure as necessity. I do not see for the moment the private pilot in the near future accepting a system of automatic pilot except perhaps in the way of an automatic relief pilot.

Mr. Thomas: I would like to add a bit on the other end of the automatic devices, and that is on the aircraft traffic control system. Obviously, if we could get a completely automatic system, it would take away all human error, and it would thereby greatly increase efficiency. Then, its effect would be on the military, commercial, or private flyer with respect to the amount of airspace that they require and the separations standards between them, making the traffic control system itself automatic. But it would not bring the improvement that we could expect if the complete system were automatic in both the airplane and on the ground.

Mr. Collins: I would not like to take exception to what Colonel Taylor said, but he did say that the private pilot was a poor man. You are talking about the small private flyers. Those airplanes, I should like to point out, average almost a third of their value in radio equipment. Some of them will put 50 percent of the value of the airplane in radio equipment.

I think generally we underestimate what the private business flyer is going to contribute to the air traffic control problem in the next four or five years.

The fleet may increase only 20 percent but it has been mentioned here that there are 12,000 IFR flights a day. They come mostly from 1,600 airliners and maybe 1,000 corporation aircraft. This fleet of 25,000 I am talking about is just now catching on to the fact that an airplane, to be useful, has to be involved in some amount of instrument operation.

Also, you might be surprised, but a lot of these airplanes will meet a Constellation at 20,000 feet, and we find also that the weather is not nearly as difficult up there, so I think the IFR operation will increase rapidly in the small business aircraft fleet.

You see many a Bonanza today with an automatic pilot in it, plus another $3,000 or $4,000 worth of radio equipment. That is not uncommon. Of course, the weight gets out of hand, so they cannot buy semi-automatic equipment. There is a limit to it, but they are pushing in the direction of IFR operations.

Colonel Taylor: Certainly the big improvements are going to come from automatic improvements. A completely automatic system, to me, is not only automatically derived on the ground but it is sent to the aircraft and the aircraft responds. What Dave is talking about is a semi-automatic system.

(Continued on following page)

Mr. Pyle: I was interested the other day to learn that at take-off minimums we were first in line, an American Convair was right behind us, and two Apaches were behind that. I think the weather at that time was three hundred and one. (*300 foot ceiling, one mile visibility.*)

We are going to have a lot of those fellows in the air with us. We are going to have to be sure that they know what they are doing.

General Doolittle: Are there technological limits to the number of aircraft the skyways can accommodate? If so, what are the limiting factors?

Mr. Timmerman: Frankly, I concern myself more with the limiting factors than trying to project into the future.

I think we have the capability, with our American ingenuity, to keep all of the airplanes moving in the airspace, provided we can overcome the limiting factors.

The first is the wasteful use of airspace by blocking out exclusive segments for particular activities. In order to have a traffic control system of adequate means, we must have complete flexibility in its use. I am not saying that the activities that go on in exclusive airspace now are not necessary. They certainly are, but we cannot afford to block it out for those particular reasons during all periods of time since most of them are not used except for relatively short periods.

Another limitation in achieving this great capacity is the lack of agreement among people like all of ourselves sitting here today as to how we can get with it and do it.

A third is the failure of some segments of the using agencies to implement their aircraft properly to insure efficient use of the system that is employed. I am sure you are all familiar with the fact that we have a double system of navigation in existence today. We are trying to handle people now flying on one system or both and coping with a situation which makes the job of the controller intolerable.

The lack of adequate communications has been mentioned. We have aircraft today with communication provisions that were only adequate in 1918. Yet these people are trying to fly through the system. The result is the traffic controller has to hand-carry them through the system. They have to give them strict attention. They have to figure out some way of giving communications through some remote channel simply because the aircraft is not equipped to operate in the system.

The truth of the matter is that we have aircraft flying in pretty poor weather conditions in high-density areas with no radio in them. We do not even have any legislation today that says you have to have a radio, even after all of these years. How are we going to get a system if we do not at least make an effort to participate in the system?

Another thing is good airport planning. We are doing some pretty poor planning today. I could name some airports that are going to be built that we know are going to, because of the location selected, cause traffic control problems, reducing the efficiency of traffic control in those areas. Yet we are knowingly planning on doing that either because the people responsible are not cognizant of the impact on traffic control or because they feel that other compelling factors are more important.

I do not think there is anything more important today than the practical resolution of this traffic control problem. Unless we lick this one we are not going to lick the other problems either.

One other thing is the lack of adequate runways. We can have the most effective air system methods of feeding aircraft from the air to the ground but if we do not have enough runways, well located, as I mentioned earlier, we just are not going to have an efficient air traffic control system. You cannot put a gallon of water into a pint bottle, and there are locations in the country today where we are trying to do just that.

Colonel Taylor: I do not believe that these are technological limits. These are limits of policy and limits of decision. From the purely technical side, I don't feel that there are limits.

During World War II and since, there has been a great deal of military and industrial development which has given us a reserve, a sort of blood bank of technology from which we can draw techniques if we really get the decisions that are needed. You might say that we have answers to problems that have not arisen yet.

I have a couple of examples. One of them is that we can measure by radio angle positions to 24 micro-range which, in inches and miles, is about one inch and one mile accuracy. We have a capability of communicating at the rate of a thousand words a second by digital data link. Dr. George Valley's computer will consider literally hundreds of variables and review these variables and come up with the proper action. We can measure by radar things we never

(*Continued on page 127*)

Concluding Remarks

• BY JAMES H. DOOLITTLE

Due to the extremely rapid increase in performance, number of aircraft, and the lack of sound and implemented planning to anticipate this growth, our nation is faced with a worsening aviation crisis. The American people as a whole are unaware of, and even aviation people, except for a few far-sighted individuals, do not appreciate the imminence and the gravity of the situation. The problems will require our best thought and effort and some considerable sacrifice.

The future development of commercial aviation, and thus its usefulness, and the future effect of military aviation, and thus our national security, will be profoundly affected by what we do or fail to do now. We must immediately conceive, decide on, develop and make the equipment and facilities necessary to permit the safe and orderly growth of commercial aviation and to assure the continued effectiveness of military aviation.

The criteria on which all military thinking must be based is that the aircraft, together with their ground facilities, equipment, and control systems, must be capable of accomplishing the assigned mission. In the case of a bomber, it must be capable of going and dropping its eggs accurately on the enemy target. In the case of a defense fighter, it must be capable of stopping enemy aircraft before they get over here.

In the case of commercial aviation, there are three requisites. One is safety, one is speed, and the other is economy. In all of these we are going ahead and we must continue to go ahead. To accomplish what we must accomplish means the expenditure of thought, effort, and dollars. Public education is imperative. The watch words are cooperation, speed of accomplishment, effectiveness, efficiency, and economy. Economy, however, must be achieved by sound, long-range planning, and the avoidance of waste and undesirable duplication, not by skimping on essentials.—END

15...20000 lbs of thrust and MORE...
...the BIG news in propulsion will come from
ORENDA
ENGINES LIMITED,
MALTON, CANADA
Box 4015, Terminal A, Toronto
MEMBER, A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

Tired of piece part and assembly problems?

LET General Mills
SUPPLY THE WHOLE PACKAGE

Save money, save time, save needless worry over hundreds of troublesome detail problems. Have those electro-mechanical assemblies you need precision manufactured, completely assembled and performance-tested by the Mechanical Division of General Mills.

We have the precision equipment and experienced people required to take over the entire job for you, from piece part fabrication or purchase to the finished product. As in our own prime contract work, we're geared to turn out precision assemblies *in quantity* while maintaining highest military standards of manufacture, design, quality control, packaging and accounting.

LET US BID on your requirements . . . write, wire or phone: Dept. AF-5, Mechanical Division of General Mills, Inc., 1620 Central Avenue, Minneapolis 13, Minn. STerling 9-8811.

Job opportunities available for creative engineers. Work closely with outstanding men on interesting projects.

MECHANICAL DIVISION OF General Mills

have been able to measure before.

We have an airborne search radar. It is a brand new development which was developed to show the airfield controller, the tower controller, what his traffic is on the ground when he couldn't see it because of bad visibility. This will work in rain, snow, and so on. Once you see the airplane turning on the ground, a controller close to this can see if the airplane is a twin-engine or four-engine plane. This will give the tower controller pictures which he could not possibly have in poor visibility.

Mr. Sayen: I think the direct answer is that we do not know what the technological limitations are from the standpoint of congestion. We do know several things. It is relative. We can pour a lot of airplanes into the airspace over and above what we are now pouring into the airspace. It depends on what kind of compromises we want to accept to do it. The military has a primary mission to perform and they need air traffic control to do it. The air traveler wants to leave on time and get there on time to meet his business appointments, and there is a point at which he will no longer accept delay, and the delay is pretty bad now. There is a point at which that will stop the expansion of commercial air transportation.

The private pilot and corporate pilot have their problems also. There is a point at which they are going to refuse to compromise any further. Then you have the next problem of what degree of hazard can you afford to accept by pouring more airplanes into the airspace. If we were able to implement all of the CAA's five-year plan in the next year, we could probably move the present level of traffic with a greatly increased level of safety

We have to move very rapidly within the extent of our present technological knowledge and our present plans, probably much more rapidly than we had planned, to meet the requirements of the users of the airspace and at the same time keep the hazard to an acceptable level.

Mr. Jean DuBuque (from the floor): Several panel members indicated that freedom of the airspace is essential for all users. What about the VFR aircraft entering into a high-density zone under marginal weather conditions where all other aircraft are converging under IFR conditions? Should they have freedom of the airspace?

Mr. Thomas: That subject is under a lot of study at the present time. We are hopeful that these experiments in the high-density areas will point the way in that direction.

Mr. Snow: You did not hear anyone speak of freedom of the airspace. We meant that all users of the airspace and their requirements should be considered in whatever system is developed so that they can have a fair share of the airspace. I cannot imagine anyone accepting the thesis that anyone should have complete freedom to travel anywhere in the airspace at any time.

Maj. Gen. Junius Jones USAF-Ret. [New Orleans Airport Commission]: How will the decision recently developed affect a possible reduction in a vertical separation and still provide adequate safety?

Colonel Taylor: I presume you mean the high-altitude separation. There is now under development a conventional type altimeter whose accuracy will enable us to get down to about 1,500 feet separation at that extremely high altitude and have about a 250-foot plus or minus error.

There is another altimeter which is quite a little further away whose accuracy will be, as we now see it, one part in five thousand. If we do not get this thing successfully developed, we may have to go into a pre-set standard

(Continued on page 130)

A letter from Daddy

TO: BARBARA ALLARD

Dear Barbara:

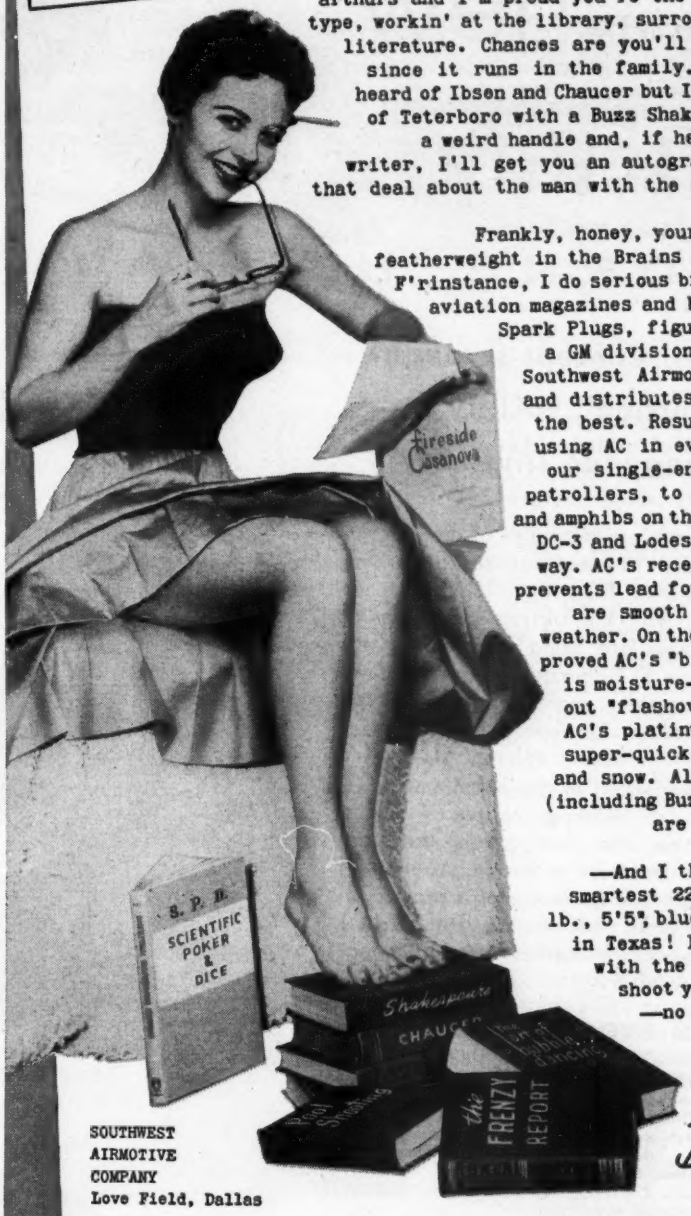
I enjoyed your note about your favorite arthurs and I'm proud you're the intellectual type, workin' at the library, surrounded by good literature. Chances are you'll be a genius, since it runs in the family. No, I never heard of Ibsen and Chaucer but I once flew out of Teterboro with a Buzz Shakespeare. It's a weird handle and, if he's kin to the writer, I'll get you an autographed copy of that deal about the man with the crazy mother.

Frankly, honey, your ole man's no featherweight in the Brains Dept. either. F'rinstance, I do serious browsin' in the aviation magazines and boned up on AC Spark Plugs, figurin' anything a GM division makes — and Southwest Airmotive services and distributes — has to be the best. Result: We're now using AC in everything from our single-engine pipeline patrollers, to our Twin Beech and amphibs on the Gulf, and our DC-3 and Lodestar up Canada-way. AC's recessed "hot tip" prevents lead fouling; engines are smooth regardless of weather. On the Gulf, they've proved AC's "big barrel" plug is moisture-proof and cuts out "flashover." Up north, AC's platinum points give super-quick starts in ice and snow. All the Thinkers (including Buzz Shakespeare) are going AC 100%.

—And I think you're the smartest 22-year-old, 126 lb., 5'5", blue-eyed brunette in Texas! If you're bored with the classics, I'll shoot you an AC catalog —no plot—just good common sense!

Love,

Daddy



SOUTHWEST AIRMOTIVE COMPANY
Love Field, Dallas

A FEW OF THE new

VICKERS®

AIRBORNE HYDRAULIC VALVES

from New "Concept-through-Production" Facility at El Segundo Division

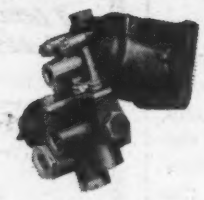
The valves shown are representative of an expanding line being built to meet rapidly advancing airborne requirements. They were developed in close cooperation with the airframe and power plant engineers who are using them. They are products of Vickers El Segundo (California) Division, which has complete engineering, laboratory and production facilities for "concept-through-production" of airborne hydraulic valves.

Thoroughly experienced in the requirements of aircraft systems and working closely with the Detroit organization, the El Segundo staff can quickly solve new problems in design. As soon as the prototype is approved, it becomes a production item in minimum time. Ask the nearest Vickers Application Engineer for further information or write for Bulletin A-5209.

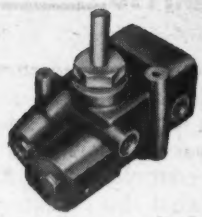
VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
1526 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering and Service Offices:
El Segundo, California, 2160 E. Imperial Highway • Detroit 32, Michigan, 1400 Oakman Blvd. • Arlington, Texas, P.O. Box 213 • Washington 5, D.C., 624-7 Wyatt Bldg. • *Additional Service facilities at:* Miami Springs, Florida, 641 De Soto Drive

TELEGRAMS: Vickers WUX Detroit • TELETYPE "TWX" DE89 • CABLE: Videt Detroit
OVERSEAS REPRESENTATIVE:
The Sperry Gyroscope Co., Ltd.—Great West Road, Brentford, Middx., England



Hydraulic Motor with Anti-Overrun Flow Control



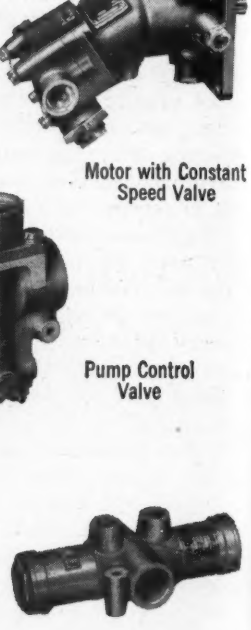
Constant Gain Nose Wheel Steering Valve

Flow-Sensitive Pressure Regulator

Motor with Constant Speed Valve

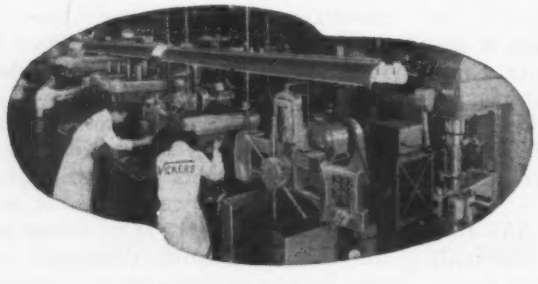
Pump Control Valve

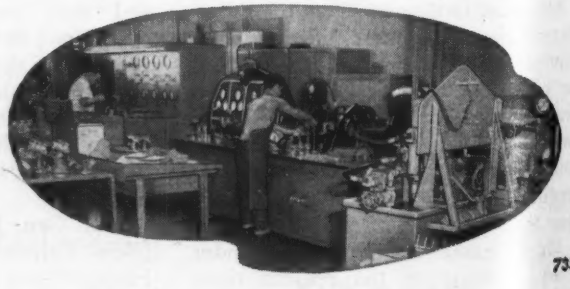
Relief Valve with Thermal Protection



Power Control Flow Regulator

Design, Development, Testing and Manufacturing at El Segundo Division of Vickers Incorporated.





7352

Tech Talk

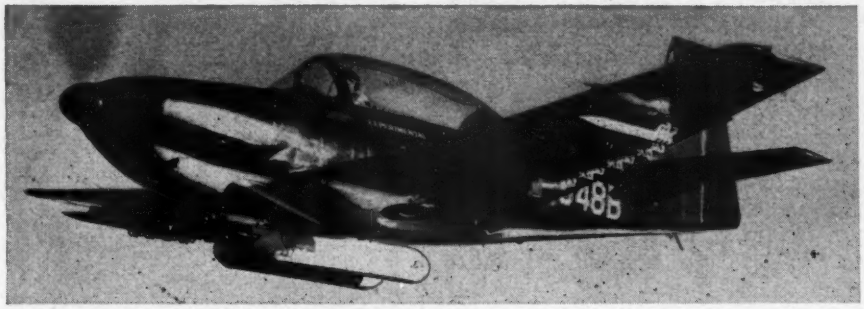
The **Defense Department has unveiled SAGE,** a giant electronic brain to help guard this nation against surprise air attacks. Known as **Semi-Automatic Ground Environment,** SAGE will play a **major part in the national defense system.** It was developed at the **Lincoln Laboratory of Massachusetts Institute of Technology,** and is in production (see also Dr. George Valley's report on SAGE elsewhere in this issue).

SAGE tracks penetrating enemy aircraft by correlating information from radar stations, ground observer posts and picket ships, and automatically **selects the most efficient defense weapon,** whether it be guided missiles or interceptor fighters. It then directs the interceptors to the target. A chain of **thirty-two SAGE centers** across the country, tied together by a **complex network of telephone cables,** will automatically direct an air battle as it progresses.

A highly **flexible and mobile shelter,** which can be picked up and dropped by helicopter, has received its **operational suitability tests** at Langley AFB. Known as the **"Helicop-Hut,"** it was designed to provide mobile communication and service units for the Tactical Air Command. Primary advantage of the shelter is its mobility—it can be transported to inaccessible locations by helicopter, **eliminating costly and time consuming construction.**

Republic Aviation Corp. has developed a **ground muffler** for Thunderstreaks and Thunderflashes, which **substantially reduces the noise** of these fighters when they are being tested at full power. Tests made in the community surrounding the company airfield indicated that the **noise level was comparable with that of normal automobile traffic** in the area. The new muffler, made of **steel covered with protective fiber glass,** absorbs the noise as it bounces around a series of sound-absorbing chambers and beams the residue skyward out the "smoke stack." Jet fighters are backed up to the muffler and **locked firmly in place on a special track.**

A dual-purpose military trainer for primary flight and armament instruction has been shown by **Temco Aircraft Corp.** The airplane was designed and produced at company expense to meet the training requirements of foreign military services. Powered with a **supercharged 340-hp Lycoming engine,** the **Model 58** has a **top speed of 185 knots** and a **range of 485 nautical miles.** It has provisions for night flying and is designed for acrobatics. Combat guns, bombs, and rockets are its most unique feature and give the student an **early introduction to the various types of armament** during primary training. No specialized equipment is required to maintain the airplane in the field, according to the manufacturer.



Temco's dual-purpose primary trainer can carry two .50-calibre machine guns, two napalm fire bombs, two 100-pound general purpose bombs and 16 rockets.

Mobile radio relay station is lifted by Piasecki H-21 helicopter during stability tests at Langley AFB, Va.

Grumman Aircraft Engineering Corp. has utilized the basic airframe of its S2F sub-killer aircraft to produce the TF-1, a **passenger-cargo-utility version** for the Navy. Grumman engineers designed a deeper, wider, roomier fuselage for the TF-1, which, stripped of the S2F's extensive hunter-killer equipment, **comfortably accommodates either nine passengers or its full cargo.** The passenger version is quickly convertible to carry cargo. During an arrested carrier landing a tremendous strain is placed on the tie-down lines restraining the cargo. To offset this, Grumman engineers developed a **"cage" to trap the load in a fixed position** for the sudden stop.—END

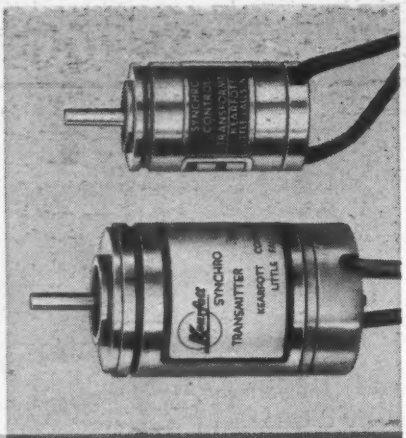
Republic F-84F Thunderstreak is coupled to a new ground muffler which suppresses three-quarters of the fighter's full-power engine noise during tests.

SIZE 8 (R1000 Series)

.750 x 1.240 inches, weighs 1.75 oz. Available as transmitters, control transformers, resolver and differentials. Max. error from EZ 10 minutes.

SIZE 11 STANDARD (R900 Series)

1.062 x 1.766 inches, weighs 4 oz. Available as transmitters, control transformers, repeaters, resolvers and differentials for 26V and 115V applications. Max. error from EZ 10 minutes.



SYNCHROS

STANDARD AND SPECIAL

SIZE 11 SPECIAL (R500 Series)

Same basic dimensions and applications as standard Size 11 Synchros. Conforming to Bu. Ord. configurations with max. error from EZ of 7 minutes.

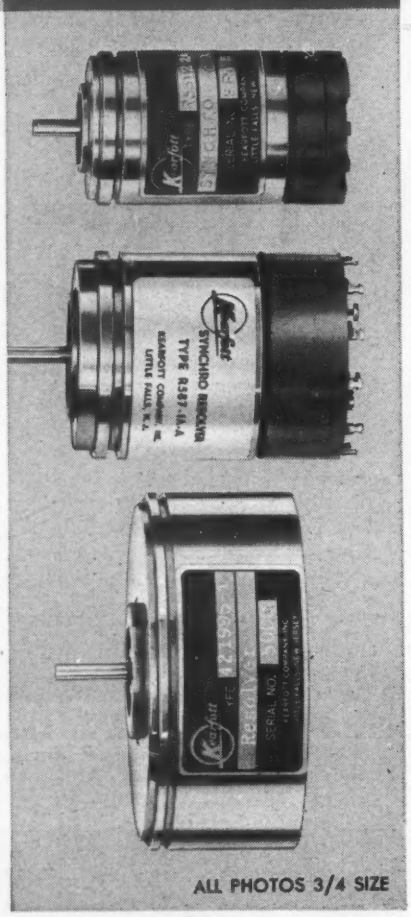
PRECISION RESOLVER (R587)

Size 15. With compensating network and booster amplifier, provides 1:1 transformation ratio, 0° phase shift, 5 minute max. error from EZ. Tangent generator explanation.

"PANCAKE" SYNCHROS

2.478 x 1.078 inches, weighs 11 oz. Available as transmitters, control transformers, resolvers, differentials and linear induction potentiometers. Max. error from EZ 2½ minutes. Suitable for gimbal mounting.

All these Kearfott Synchros are constructed of corrosion resistant materials, thus enabling them to be operated under adverse environmental conditions.



ALL PHOTOS 3/4 SIZE

KEARFOTT COMPONENTS INCLUDE:

Gyros, Servo Motors, Servo and Magnetic Amplifiers, Tachometer Generators, Hermetic Rotary Seals, Aircraft Navigational Systems, and other high accuracy mechanical, electrical and electronic components.

Send for bulletin giving data of Counters and other components of interest to you.

Kearfott

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

KEARFOTT COMPANY, INC., Little Falls, N. J.

Sales and Engineering Offices:
1378 Main Avenue, Clifton, N. J.
Midwest Office:
188 W. Randolph Street, Chicago, Ill.
South Central Office:
6115 Denton Drive, Dallas, Texas
West Coast Office:
253 N. Vinedo Avenue, Pasadena, Calif.

AIR TRAFFIC——CONTINUED

barometric reading above the extremely high altitudes in order to achieve some semblance of accuracy with a buffer zone of perhaps 2,500 or 3,000 feet between the barometric setting and standard setting.

J. B. Hartranft, Jr. [President, AOPA]: We have enough problems, I think, to deal with without disagreeing among ourselves. I think we pointed out many times, in various committees, that in our present brand of twin-engine aircraft coming off the production line, if we take collectively the production of the Aero Commanders, and the Piper Cub, Apaches, and the Beech Twins, and so on we are producing each year as many twin-engine aircraft as the airlines operate.

There are very few airplanes coming off the production line now that are not equipped with two-way radios. Let us not exaggerate our problems.

Samuel Freeman [President, National Aviation Trades Association]: Is there any plan in high-density areas to use the radars which are now set up and operating at many of the Nike sites? I would think that, particularly in relation to helicopter and slow aircraft navigation in areas such as the New York area, there might be some way of tying the radar information gained by those sets which are obviously manned 24 hours a day and collating or collecting that information into the traffic control setup where it could be of some use.

Most of us in general aviation are perfectly willing and able to go along with the idea of two-way radios. As has been pointed out, nearly all of the new airplanes have it anyway, but I do think that consideration should be given to whether you have 360 channels or not. In other words, you will find we will gladly buy reasonable radio equipment, but it is almost literally impossible to buy IFR in the New York or Philadelphia area without 25 or 30 channels of radio equipment, which is quite a burden for the smaller aircraft.

Mr. Thomas: There are no plans to encompass the Army's radar of the type that you mentioned. Our present plans pretty much are confined to ADC, Navy, and other military radar which are being made available specifically for traffic control purposes.

The big problem is actually one of economics, of collecting and collating information from different radars, and once you have done that for the computer we have SAGE, so I think the collation job will be in the SAGE system itself.—END

problems. They all have noise groups, acoustical groups brought together with the aerodynamicists, the propulsion people, and now, as Mr. Littlewood has mentioned, this is a structural problem also. What can be achieved? How does this compare with what we thought a year ago on the scientific front? A lot of people would have said the problem is hopeless. Some people say today it is horrible, but there are even more of them who say there is real hope for gains in the problem of reducing noise at the source without too great a penalty. We do not exactly know what this will amount to; it is small at the moment, but it is getting bigger every day.

Mr. Littlewood: I omitted two very important aspects, one of accomplishment and one of investigation.

In the area of ground run-up, which is not important to the take-off, particularly of jet-type aircraft, but is important as a servicing operation for check purposes, we have complete control of the situation. We can reduce it to any amount. We feel that that is no longer a matter of basic research.

The area of investigation which I did not mention is the area of aerodynamic noise above 550 miles an hour, in which you get into subsonic operation and completely into supersonic, and you begin to generate aerodynamic noises which become increasingly more troublesome. The opening up of the wheels, for instance, introduces a new noise. Things are being done about that. The solution seems to be pretty well indicated. Boundary layer control may ultimately come into use as a matter of taking care of skin noise. The pilot does not get the exhaust noise but he does get aerodynamic noise, and the noise has a habit of increasing with turbulence.

From the floor: We have recently had a problem precipitated by the Veterans Administration and FHA. They have banned loans to veterans who wanted to buy homes within two miles of an airfield. The repercussions are still there and have existed for some time. I would like to ask if any effort is being made to incorporate those two agencies in any coordinating committees?

Captain Phoebus: I can answer that partially at least. Within the Armed Forces NRC Committee on Hearing and Bio-Acoustics, we do have liaison with the Veterans Administration. Contact with the FHA so far has been on a consultation basis.

On the location of housing, the legal aspects are the subject of a great deal of discussion in at least the Air Force and the Navy.

Dr. Bolt: This is a program that is being conducted for the Air Force to gather basic engineering information which will make it possible in time to put numbers into the types of solutions that were brought out this morning. It is clear that part of the over-all solution to the noise problem, the effect of noise on communities and on base operations, part of the solution lies in the way you distribute your facilities, where are the holes, where are the test facilities, where are the air lanes? But we do not have enough engineering data to say exactly how far away to build a house or where is the best spot for an officers club, a hospital, and so on, and a broad program of surveys at a number of air bases is underway at which measurements are being obtained on all of the types of noise makers. Measurements are being made on propagation of sound across actual air bases including the effects of weather and buildings, and measurements are also being made on heat, and within the next year or so in the broadly cooperative program with the services, I think we will begin to have more solid engineering information for rational planning of airports and air bases in general.

From the floor: There has been some talk of raising the spectrum of sound up to the level where it gets beyond what the human ear can hear. I remember they tried that at airports to keep birds away and found that it killed cats. I am wondering if some of you people could indicate whether any research has been done to find out what physiological effect this might create on human beings?

Dr. Parrack: The very first part of the air research and development program was concerned with the effects on man and animals when exposed to these higher frequencies. I think it can best be quickly summarized by saying that if you cannot hear it, it won't hurt you, if the transmission is through air.

From the floor: I wonder about the sonic boom you spoke of before. Say a plane pulled out of a dive; would it do much damage besides breaking windows?

Mr. Streid: It, of course, does the same amount of damage as any strong sound wave. Of course, it depends on the amount of energy in it. This sonic boom is generated only when a plane itself flies at sonic speed. It is not generated when it flies slower than that, and it is not generated when it flies at higher speeds, so supersonic airplanes do not generate supersonic booms. This is a highly directional phenomenon. An airplane flying even at sonic speed at high altitude booms in the direction it flies and it does not have any effect on ground around it unless it happens to make a dive and then the boom will go ahead in the same direction, so, a normal boom at normal flight will not generate any sonic damage or cause any damage.

From the floor: Is there a direct relationship between engine efficiency and noise? I ask this question for several reasons. Brief noise is energy output from the energy which does not go into the propeller of the airplane. Secondly, we know the Conway by-pass engine is less noisy and supposedly more efficient. Third, when we use an afterburner, we get considerable noise and less efficiency. Should we attack noise perhaps from the standpoint of increasing engine efficiency?

Mr. Littlewood: I am sure there is no direct relationship between noise and over-all efficiency of the thrust or power generated. The amount of energy which is translated into noise is a very, very small amount of the total energy created by the unit.

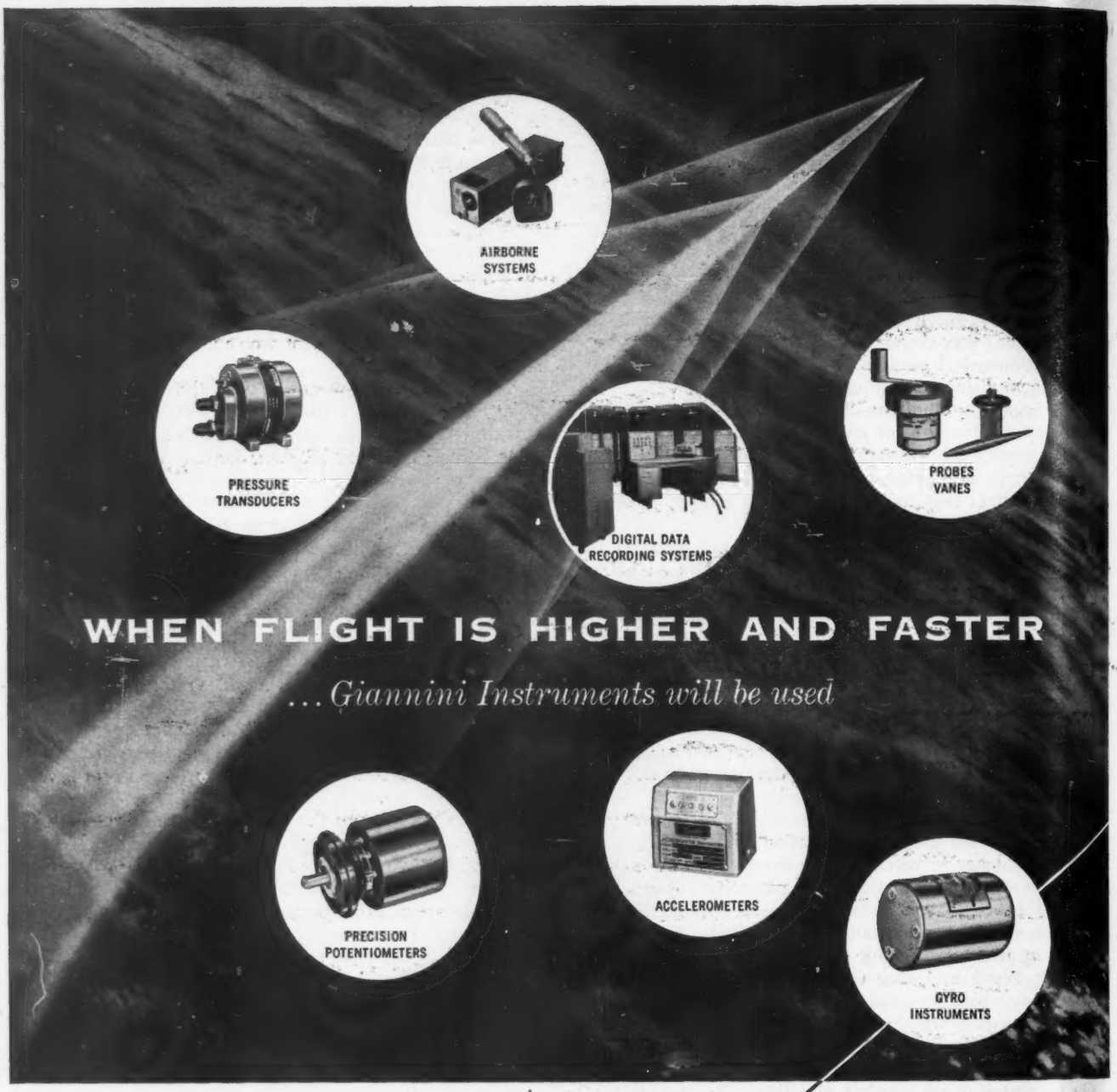
I would differ with your conclusion about the Conway engine. Where your object is to get very high speed and you have to go through pretty high jet velocity, you have a relationship that establishes a high noise level.

When we first tackled this problem of noise, we were faced with the assumption that noise bore a minute percentage relationship to the amount of energy developed, but the answer to that was this: As you walk by the Commonwealth-Edison Company, you realize that they are generating 1,000 kilowatts of electricity and if you listen attentively you can hear the hum. There is much concrete between the public sidewalk and the condensers on the inside of that building. They have heavy pipes and other things which absorb and suppress the noise, but there is no essential relationship between the noise emitted and the power generated.

From the floor: Is anything being done at the present time to convert the noise of the jet to a high frequency which would be inaudible to the human ear?

Dr. Smull: Studies of this nature are under way, however, the results thus far indicate that, in the configurations that we know at present, they are very impracticable from the flight standpoint. This is a thing that we like to work on. It is a long way off at the moment for practical use.

—END



Scientific achievement in the field of aircraft and missile development is literally attaining new horizons ... Keeping pace with those milestones of progress, Giannini, too, is advancing—both in theory and in practice.

Reducing the art of high speed high altitude instrument design to a science, Giannini engineers and scientists apply knowledge acquired through years of extensive experience with commercial and military aircraft instrumentation. When flight becomes higher and faster, the intensive research policy and progressive design practice at Giannini will continue to provide solutions to the ever increasing problems of the aircraft industry.

Giannini

FOREIGN SALES OFFICES:
MILANO, ITALY,
Via Alberto Da Giussano
LONDON E. C. 2, ENGLAND,
Giannini Limited, 31/45 Gresham Street

REGIONAL SALES OFFICES:
NEW YORK 1, N.Y., Empire State Bldg., CHickering 4-4700
CHICAGO, Ill., 8 So. Michigan Ave., ANdover 3-5272
PASADENA, Calif., 918 E. Green St., RYan 1-7152
MONROVIA, CALIF., 1307 So. Myrtle Ave., ELliott 9-5381

Engineering positions are open at several Giannini locations for career-minded young men—write for details.

G. M. GIANNINI & CO., INC., PASADENA, CALIFORNIA

Utah Wing Holds Airpower Symposium

'BEST PROGRAM TO DATE' GETS UNDER WAY AS GOVERNOR PROCLAIMS 'AIRPOWER WEEK'

SQUADRON OF THE MONTH

The Utah Squadrons

CITED FOR

outstanding contributions to better understanding of airpower and its role in the defense of freedom and the maintenance of world peace, through their sponsorship of the Airpower Symposium.

AFA's **Utah Wing,** though young in comparison with some other AFA units, has come of age in its programming. The group's **Airpower Symposium,** held in Salt Lake City the week of January 23-28, could hardly have been any better. It demonstrated conclusively how far an AFA unit can come in less than two years.

The program got under way when Utah's **Governor, J. Bracken Lee,** who is himself a private pilot, proclaimed "Airpower Week" in Utah. On Thursday noon, January 26, the **Salt Lake Exchange Club** turned over its facilities to the Wing at a time usually reserved for the Club's own weekly luncheon. Club members were invited to attend the AFA luncheon at which **AFA Board Chairman John R. Alison** was the main speaker. In all, some 550 people heard Mr. Alison's remarks about the aviation industry's role in the national defense picture.

The following day at the kick-off luncheon at the **Hotel Utah,** Governor Lee again took part in the program by extending an official welcome to the guests. About 250 people heard retired USAF **Maj. Gen. Orvil A. Anderson,** who is a native of Utah and a well-known airpower expert, trace the development of military aviation and outline its present place in the defense picture.

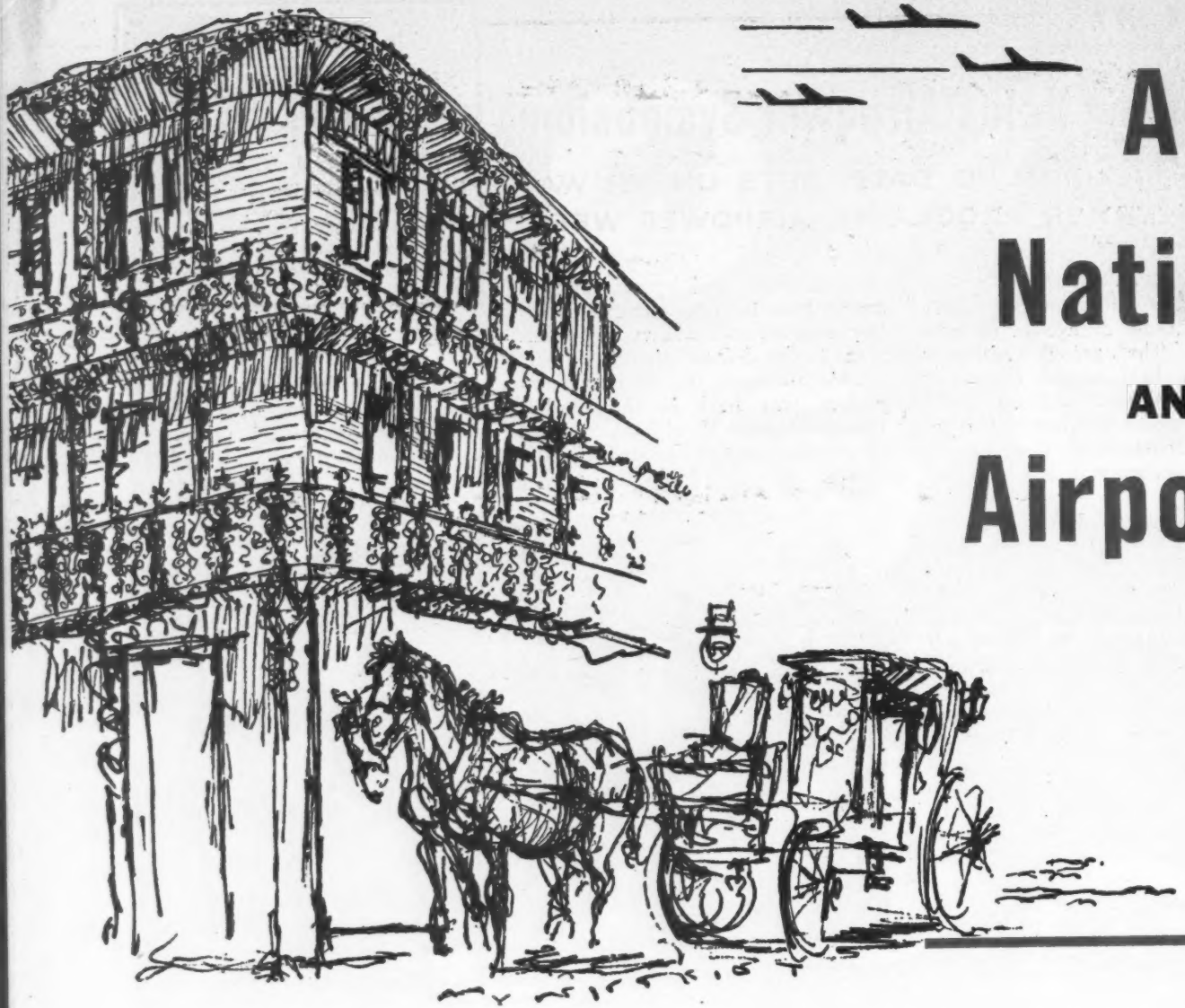
That afternoon the **Industry Symposium** was held in the Starlite Lounge atop the Hotel Utah. A panel of aviation experts, headed by Mr. Alison, in his dual capacity as AFA Board Chairman and Vice President of Northrop Aircraft, addressed the

(Continued on page 136)

Here are some of the men who made things tick at the Utah Airpower Symposium. Standing, from left to right: Joe Jacobs, Bob Rampton, Lee Florence, Paul Simmons, Chuck LeMay. In the front row, from left: Don Burkholder, Maj. Gen. Manning E. Tillery, and Col. Lester L. Kunish. Colonel Kunish is credited with being the first to strike the organizing spark for AFA in Utah.

Miss Helen Daines, the Utah Wing's Miss Airpower, is flanked by her runners-up in Symposium Beauty Parade. On left, Phyllis Hansen; on right, Franeel Purrington.

Utah Wing's George Van Leeuwen, holding model, discusses Symposium with Marvin Fischer, Ogden Commander; David H. Whitesides; and Ute Commander Don Hartley (see text).



AFA's 19
Natio na Co
AND
Airpow e Pa

Augu 2-3-

Ne rlea

NOT since the days when Jackson and Lafitte joined forces in the Battle of New Orleans will there be as much "battle talk" as when some 2,000 AFA members and friends assemble in New Orleans for the Air Force Association's tenth annual National Convention and 1956 Airpower Panorama. "There I was at 40,000 feet" and "Things were rough in MIG Alley" will ring up and down Canal and Bourbon Streets, as air wars are re-fought and battles are re-won. The South will be invaded all over again, not by conquering sword swingers, but by airmen just wanting to enjoy southern hospitality while in New Orleans.

Already, more people have reserved rooms for the AFA Convention in New Orleans than two months later for previous Conventions. Everything points to more people having more fun in New Orleans than ever before at an AFA affair. A look at the program highlights at the right is a good indication of what is in store for everyone attending the 1956 Convention. Better make your plans now to be on hand for everything. It will be the biggest and best airpower get-together anywhere in the country—make sure you and the family are there.

- ***Wing Ding Mardi Gras***
- ***Airpower Awards Banquets***
- ***Ladies Fashion Luncheon***
- ***Industry Briefings***
- ***Unit Reunions***
- ***Fashion Tour and Tea***
- ***AFA's Tenth Birthday Party***
- ***Airpower Panorama***
- ***World-Famous French Quarter***
- ***Airpower Symposium & Luncheon***
- ***Reserve Forces Clinic***
- ***Basin Street Jazz***

1956 Convention Panorama

1-2-3-4-5, 1956

New Orleans, Louisiana

REUNION BIRTHDAY PARTY

AFA's 1956 Convention will have a special reunion spirit. It marks AFA's tenth anniversary. Naturally there will be a birthday party, with cake and ice cream, and some fortified punch, plus a little special entertainment. In addition to AFA's birthday party, the Night Fighters, Medics, Chaplains, POWs, bomb groups, and fighter outfits will have parties of their own. Each of these is a little convention. Last year in San Francisco, for instance, the Night Fighters had over three hundred members at their party. Lt. Gen. Frank F. Everest, Deputy Chief of Staff, Operations, spoke at their luncheon. We expect more reunions of wartime outfits in New Orleans than at any AFA Convention in previous years. There is something about the name "French Quarter" that makes for a good reunion. If you want to get the members of your outfit together in New Orleans, drop a note to AFA Headquarters in Washington, with the details, and AFA will spread the word. You will be amazed how many will show up. By combining your reunion program with AFA's Convention events, the members of your outfit will have plenty to see and do in New Orleans.

HEADQUARTERS: ROOSEVELT & JUNG HOTELS

HOTEL RESERVATIONS

The four New Orleans hotels listed below have reserved 1,500 rooms for the Air Force Association's 1956 Convention and Airpower Panorama. A special housing office has been established at the New Orleans Convention Bureau to handle hotel reservations for the Convention. All reservation requests MUST be sent to the AFA Housing Office, not to AFA in Washington or directly to the hotels. All four hotels are air conditioned. No advance deposits are required.

ROOM RATES

HOTEL	SINGLE	DOUBLE	TWIN
Roosevelt	$7-8-9	$10-11-12	$14-15-18
Jung	$7-8-9	$10-11-12	$11-12-14
St. Charles	$6-7-8	$ 9-10-11	$11-13-15
Monteleone	$6-7-8	$ 9-10-11	$11-13-15

Parlor Suites

One Bedroom . . . . $25 & Up

Two Bedroom . . . . $40 & Up

FILL IN, CLIP AND MAIL TODAY!

mail to: AFA HOUSING OFFICE
New Orleans Convention Bureau
315 Camp Street
New Orleans 5, La.

Date.....

NAME .....

ADDRESS .....

CITY & STATE.....

HOTEL..... .....
First Choice Second Choice

....
Type Room Desired Rate

ARRIVAL DATE & HOUR.....

DEPARTURE DATE.....

OTHERS IN ROOM.....

.....

Combines For the First Time

Pantobase

(All Bases)

and

BLC

(Boundary Layer Control)

It is with pride that Stroukoff Aircraft is producing for the United States Air Force the most efficient advanced assault air transport in the history of military aviation.

This development combines slow landing speeds through means of the Boundary Layer Control system, and includes the Pantobase installation, both designed by Stroukoff Aircraft Corporation.

The MS-8-1 is able to land and take-off from unprepared surfaces such as rough terrain, sand, snow, ice, ordinary runways and to operate from water as well. It will do so at low speeds never before possible with aircraft of its weight; and in half the area needed by its prototypes.

UNUSUAL OPPORTUNITIES

For Qualified Engineers — now — in this progressive Aircraft Research and Development organization. If interested please send resume to Mr R. C. Ward, Director of Personnel, Stroukoff Aircraft Corporation, West Trenton, N. J.

STROUKOFF AVITRUC

Stroukoff Aircraft Corporation

WEST TRENTON NEW JERSEY

gathering and answered questions about America's aviation industry.

Joseph Rosenblatt, President of the EIMCO Corporation, served as moderator. Other panel members included **Maj. Gen. Manning E. Tillery,** Commander of AMC's Ogden Air Materiel Area; **Bernie Diamond,** from the Ogden Chamber of Commerce; **Frank M. Crismon** of United Airlines; **Harlon W. Bement,** representing the Utah Aeronautics Commission; and **Joe Bergin,** manager of the Salt Lake Municipal Airport.

That evening nearly 1,000 people attended the **Symposium Variety Show** and the Airpower exhibit, held in the Rainbow Randevu. During the program, eleven beauty contestants paraded before the judges, vying for the title **"Miss Airpower of Utah."** The title was won by **Miss Helen Daines** (*see cut*). The AF-ROTC drill teams from three schools—**Brigham Young University, Utah State Agricultural College,** and the **University of Utah**—impressed the group with precision maneuvers.

Then the crowd toured the exhibits in the hall. Among the industries and agencies who had exhibits were Northrop Aircraft, Hill Air Force Base, Cessna, Kemp & Kelsey, the Tactical Air Command, United Airlines, the Air Materiel Command, the Air Defense Command, the Air Force Reserve, and Weber College. An F-86 Sabrejet set up on the sidewalk in front of the building by the 191st Fighter-Bomber Squadron of the Utah ANG attracted much interest.

This month, for the first time in the history of this column, AFA News is devoted to only one event. We think you will agree with us that the Utah Wing Airpower Symposium was successful enough to warrant this sort of coverage.—The Editors.

The first event on the Saturday program was the **Airpower Educational Symposium,** moderated by Dr. **Roland H. Spaulding,** head of the Aeronautical Educational Department of New York University. Panel members included **Dr. Daryl Chase,** President of the Utah State Agricultural College; **Dr. S. M. McMurrin,** from the University of Utah; **Dr. E. Allen Bateman,** Superintendent of Public Instruction for Utah; **Maj. Gen. Matthew K. Deichelmann,** Commandant, AF-ROTC; **Lee H. Florence,** Civilian Personnel Officer at Hill AFB; **Dr. Robert M. Ashby,** Chief

(Continued on page 139)

Stretching the Path of an Electronic Pulse

Military coding equipment takes one pulse and inserts it into a delay line and in effect sends it over a number of paths, each of different lengths. Combining the output of the paths gives a pulse train with pulses spaced in accordance with artificial length of the path. Ordinarily the flexibility of the equipment is limited by the fixed taps in the delay line and the accuracy is established by auxiliary circuitry.

Now Admiral research has developed a completely new type of delay line which is infinitely variable within its over-all capacity. It is adjustable with the greatest facility for any desired interval. The accuracy of this line is limited only by the accuracy of the measuring equipment. Moreover, the Admiral delay line requires less complicated switching apparatus. Weight and bulk are reduced. Fewer components permit faster production at lower cost. Here is one more example of Admiral's capabilities in the field of military electronics. Address inquiries to:

Admiral
CORPORATION
Government Laboratories Division
Chicago 47, Illinois

LOOK TO ***Admiral*** FOR
• RESEARCH • DEVELOPMENT • PRODUCTION
in the fields of:
COMMUNICATIONS, UHF and VHF, airborne and ground.
MILITARY TELEVISION, receiving and transmitting, airborne and ground.
RADAR, airborne, ship and ground.
RADIAC • MISSILE GUIDANCE • CODERS and DECODERS
TELEMETERING • DISTANCE MEASURING • TEST EQUIPMENT

FACILITIES BROCHURE
describing Admiral plants, equipment and experience sent on request.

ENGINEERS! The wide scope of work in progress at Admiral creates challenging opportunities in the field of your choice. Write to Director of Engineering and Research, Admiral Corporation, Chicago 47, Illinois.

minute men

WHEN SECONDS MEAN SURVIVAL, ground support equipment of unquestionable reliability is the indispensable factor. As a pioneer in all phases of ground support, CONSOLIDATED has developed units of broad application for maintaining missiles or piloted aircraft at a constant ready. Through design, development and manufacture, we have solved the most complex problems of providing self-propelled, multi-purpose units . . for towing, testing, servicing and starting guided missiles and jet aircraft . . . . . quickly, surely and under the most difficult operational conditions. Several of CONSOLIDATED's models are now being used extensively by the U. S. Air Force, Navy and Marines.

MODEL 2100 INCORPORATES HYDRAULIC, A. C., D. C. ELECTRIC, AND TOWING.

IN THE EXACTING FIELD OF GROUND SUPPORT, CONSOLIDATED HAS DEMONSTRATED ITS ABILITY TO MEET THE MOST COMPLEX DEMANDS

CONSOLIDATED
DIESEL ELECTRIC CORPORATION

STAMFORD, CONN. BRANCHES · DALLAS, TEX. · DAYTON, OHIO · SANTA ANA, CAL. · WASHINGTON, D. C.
IN CANADA · CONSOLIDATED DIESEL ELECTRIC CORPORATION · OTTAWA, ONT.

Hagerstown, Md., Squadron officers accept Charter from AFA President Wilson. Commander Barclay holds the charter; Mayor Winslow Burhans is at far right.

Engineer, Autonetics Division of North American Aircraft Co.; and **Col. Thomas L. Crystal,** from the Air Force Academy.

Aviation Education was also the theme of the Symposium luncheon on Saturday. Dr. Spaulding was the principal speaker. He is widely recognized as an outstanding authority on air education, which was the subject of his thought-provoking address.

Maj. Alexander P. de Seversky, the aircraft designer, author, and lecturer, was the guest speaker at the Airpower Banquet Saturday evening. About 400 guests heard his remarks on the need for American airpower supremacy in our national security.

An **Airpower Ball** at the Randevu, where the guests danced to the music of Tommy Alexander, wrapped up the program. At the ball, Miss Airpower was formally crowned. Miss Daines, the winner of the title, was sponsored by the AF-ROTC unit at Utah State Agricultural College. Along with her crown she received a set of luggage and other gifts.

One of the basic aims of the Air Force Association is educating the public to the nation's airpower needs. The Utah Wing's program was a fine example of how one group can do its part in this mission, and for their contribution all members of this Wing deserve the commendation of AFA. **George Van Leeuwen,** Wing Commander, was in charge of the Symposium. His over-all chairman was **David H. Whitesides.** The hard-working Program Committee chairman was **Paul A. Simmons.**

Charles M. LeMay headed the Arrangements Committee; **Lee H. Florence,** Invitations; **Donald Burkholder,** Exhibits; **Joseph Jacobs,** Finance; and **Robert Rampton,** Publicity. Their committee members worked countless hours to assure the success of the program.

A remark by John Alison pretty well sums up AFA's feeling about the Utah Wing program. He said, "This is **one of the greatest things** I've ever seen. It emphasizes the role that the AFA unit plays in the community."—END

75 YEARS

ON THE JOB

CHAMBERS

FOR

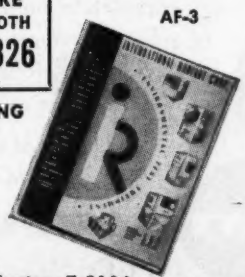
ENVIRONMENTAL TESTING

MEMBER E.E.I.

VACUUM OVENS
HUMIDITY
HI or LO TEMP.
SAND & DUST
SUNSHINE
RAIN
SALT SPRAY
IMMERSION
FUNGUS
AIR CONDITIONING
DIAPHRAGM EXERCISERS
WALK-IN ROOMS
LIQUID HOT & COLD BATHS

IRE BOOTH #826

WRITE FOR CATALOG AF-3



Phone: POrt Washington 7-3184

INTERNATIONAL RADIANT CORP.

4 MANHASSET AVENUE PORT WASHINGTON, NEW YORK

Attention AFA Members!

SEE PAGE 134

Can you meet the requirements outlined below? If so, take the *next* step toward a well-paying future as a United Air Lines' Flight Officer. Send for new booklet that gives you all the facts.

Requirements: a commercial pilot's license with 165 hours or more (no multi-engine time required); a U.S. citizen and a high school graduate between the ages of 21 and 30; between 5 ft. 7 inches and 6 ft. 4 inches in height; and able to pass a flight physical without waivers. Applicants with C.A.A. instrument rating or flight engineer examination written portion passed will be accepted through age 31; with Instrument rating and superior flight qualifications, through 32. Successful applicants attend United's Flight Training Center at Denver; receive pay while training.

Excellent pay...you get $485 a month as soon as you go on line duty. Your pay increases, too, at regular intervals.

Many extra advantages, too, as well as good pay and rapid advancement. A broad insurance program, retirement income plan and other benefits.

Plan your future now! United's continuing growth will maintain the need for qualified men for years to come. Send for booklet today.

C. M. Urbach, Supt. of Placement
UNITED AIR LINES
Operating Base, Dept. Airfo-3
Stapleton Airfield, Denver 5, Colorado

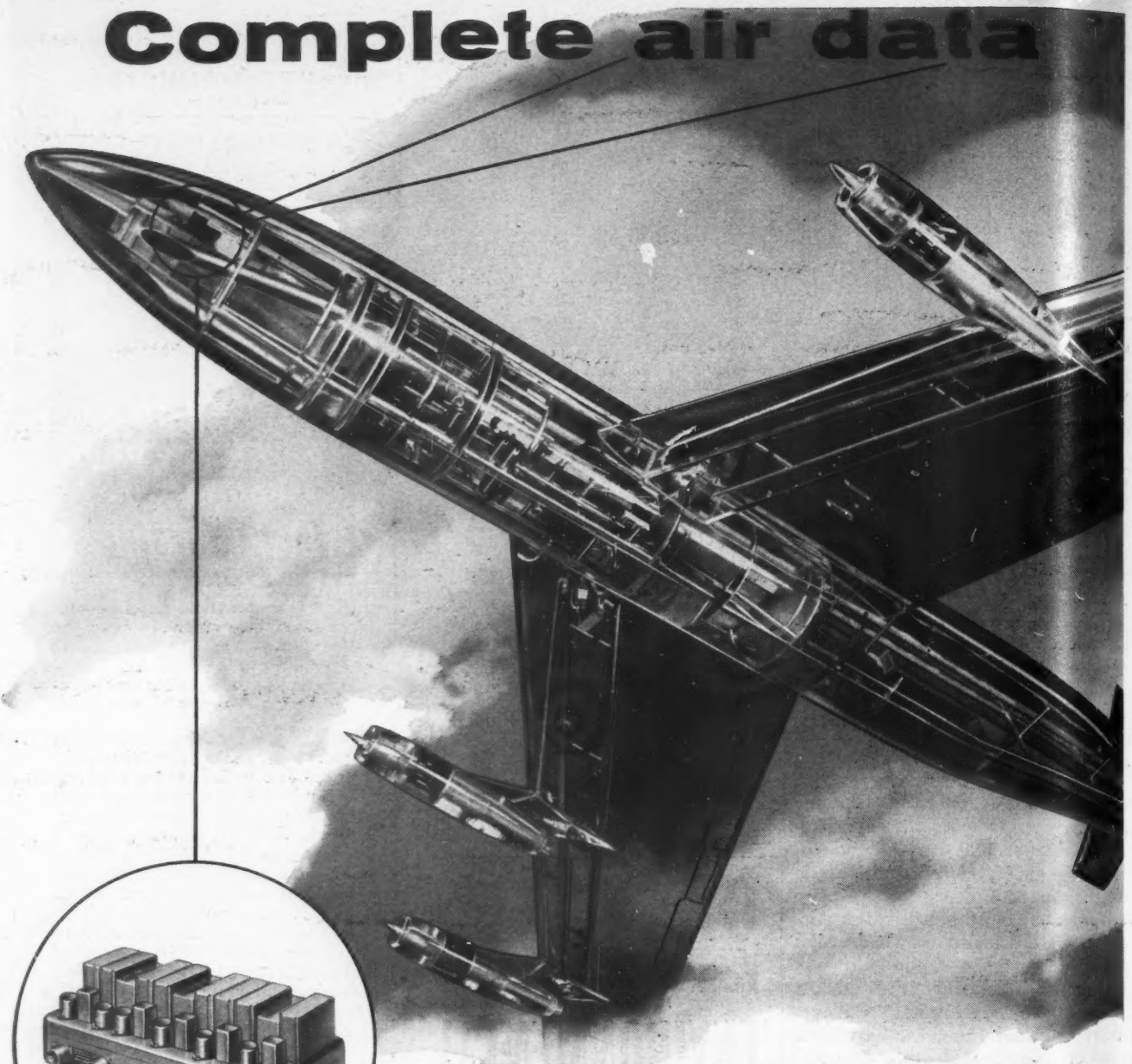
Please send me your booklet that tells me how I can become a Flight Officer with United Air Lines

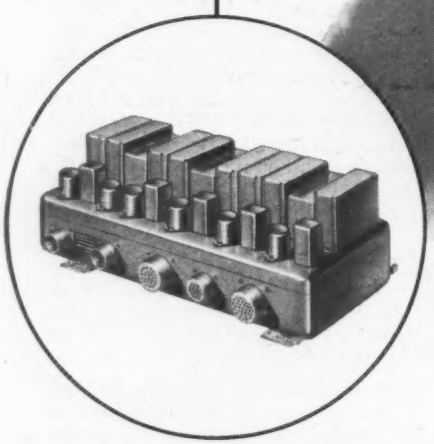
Name.....

Address.....

City.....Zone....State.....

Complete air data





CENTRAL AIR DATA COMPUTER
BRAIN OF THE AIRESEARCH SYSTEM

Complete system functions include providing true airspeed, true angle of attack and yaw, relation to Mach number, density and rate altitude, engine pressure ratio, true dynamic and static pressure, cruise control and other factors.

in one system

Here is a system that provides for the most efficient aircraft operation. It supplies all pertinent air data information to the flight engineer and pilot, or automatically makes in-flight adjustments. Similar systems are available for missiles. The air data computer system is one of many integrated systems completely engineered and manufactured by AiResearch. In the field of aircraft systems and integrated components, AiResearch has more development, manufacturing, operational and service experience than any other company.

• Qualified engineers in the fields listed below are needed now. Write for information.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Designers and manufacturers of aircraft systems and components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS
CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

Never Underestimate Your Crew Chief

By Kenneth Kay

A fine crew chief was M/Sgt. Clint Childs. But he had his heart set on being a cook . . .

HE SALUTED smartly, a lean non-com with a tough, confident face. "Master Sergeant Clinton Childs reporting for duty, sir."

CWO George Lawton, the base flight maintenance officer, noting Childs's well pressed blues, clean shave, and the mirror gleam of his shoes, nodded approvingly. "Glad to have you with us, Sergeant. How'd you like to take over as assistant hangar chief to Oldham there?"

Sergeant Oldham, leaning against the wall, smiled expectantly.

"I wouldn't, sir," said Childs. "I want to be a cook."

Lawton was startled. "What did you say?"

"I said I want to be a cook, sir. I want to transfer to Food Service."

The Warrant Officer swiveled his chair and glowered out at the wash-rack where they were scouring down General Drew's plushed-up old B-17 in case the Flight Surgeon let the general fly in the morning. A *screwball,* he thought disgustedly, *they've sent me another screwball.* "Listen, son, your records say you're a maintenance technician with fourteen years experience. They don't say a thing about you being a cook."

"I know it, sir," said Childs stubbornly, "but it's still what I want."

"Hell's bells!" exploded Lawton. "If that's what you want, why don't you get out of the service?"

"I ain't any civilian, sir," said Childs patiently. "I'm a thirty-year man. Besides, I don't mind working on airplanes. It's just that I'd rather cook."

Lawton scowled. "Maybe you bet-

(Continued on following page)

ter get married then and cook at home."

Childs looked pained. "Don't seem hardly fair, sir, that the Air Force expects a man to get married for no better reason than that."

"I'm not ordering you to get married!" yelled Lawton. "I just suggested it. What's with all this cooking anyway?"

"Alphonse started it," said Childs. "He was in a Maqui band I laid out with one winter after my B-17 was shot down over France—a little roly-poly Frenchman that'd been a chef before he joined the resistance. He could put frost-bit leeks and onions in a helmet with some mouldy potatoes and a beat-up rooster and some herbs and come up with the tastiest vichysoisse you ever laid a lip over. Killed a hare once and, while we pinned the Krauts in a farmhouse with a Bren gun, Alphonse sneaked in the barn, milked a cow and stole some mushrooms and that night fixed us a fricasseed hare I still dream about." Childs smacked his lips reverently. "Alphonse got me started on cooking. Said I had the instinct for it."

Lawton looked at him curiously. "You've wanted to be an Air Force cook all this time?"

"No sir. Collecting recipes was just a kind of hobby at first. A Bavarian in occupied Germany showed me how to make Koenigsberger Klobs, and in Italy I found out about olive oil and pasta, and then they shipped me to the Pacific. War ended and I flew to Bangalore and found out about curries. My next overseas tour was in Japan and all I learned there was sukiyaki, but I learned eighteen different kinds. Went to Hong Kong on leave—now there's cooking for you! Cinnamon duck and sweet and sour sauce, and baby octopus—"

"Stop it!" yelled Lawton. "Even if they transferred you to Food Service you couldn't serve octopus to the troops."

"No sir," said Childs, earnestly. "But you can do other things. The Air Force has got plenty of good mechanics, but mighty few really first-class cooks. Now you take spaghetti and meatballs. Add a little marjoram and. . . ."

"You're making me hungry," interrupted Oldham, grinning.

"Sergeant Childs," said Lawton, "I'm convinced. But I can't do a thing for you. If I sent a 43171 to a classification board to convert to a cook, they'd reclassify me right into the hospital booby ward. You better forget about it."

"I can't forget it," said Childs, steadfastly. "It's not any use trying. I'm bound to be a cook, I aim to be a cook, and somehow I'm going to get to be a cook."

Lawton stared at him, fascinated. His telephone rang and he answered it. "Yeah. Yeah. Call you back." He turned to the hangar chief. "Oldham, who can crew a B-17? The general's flying to California after all and Martin's sick and Stewart's on emergency leave."

"Oh Lord," moaned Oldham. "Nobody, sir. That's an awful obsolete airplane, Mr. Lawton."

"You better find somebody," said Lawton. "If General Drew wants to fly I'm not stopping him. Even if I have to send you to crew."

Oldham looked unhappy. Sergeant Childs stood up. "I can crew a B-17, sir."

"You?" snarled Lawton. "I thought you wanted to be a cook."

"I do, sir. But I'll work for you till I get to be."

"Well, I'm damned," breathed Lawton. "Okay, you're elected. Report to Operations. And thanks, Sergeant."

Oldham overtook Childs in the hangar. "What do you think you're up to?"

"Just doing my duty, Chief," said Childs, innocently. "By the way, is this the same General Drew that always has a galley in his airplane?"

"Where'd you know him?"

"Weisbaden. That general's a gourmet, Sarge. Had him an Alsatian chef and put on dinners that were famous all over the ETO. General Drew appreciates cooking, Chief, and he won't care doodly-squat about classification boards if he wants a personal cook." Childs winked and sauntered on to Operations.

"Well, I'll be go to hell," murmured Oldham, and grinned. "Wonder what that boy's going to do when he finds out the Old Man's having stomach trouble?"

After they briefed him in Operations, Childs took a look at the general's airplane. Old as she was, her soaring tail and graceful lines gladdened his eye. He climbed into an upholstered, blue-gray passenger compartment with a lavatory aft and a compact galley with a three-burner electric range.

Childs smiled happily. Tomorrow General Drew was going to be surprised with the finest airborne lunch of his career, and after that—well, Childs figured his knuckle-busting days were over.

He had thirty-two dollars. He drove to a supermarket and filled his B-4 bag with fancy groceries. Then he pulled rank on a mess steward and simmered onion soup half the night on a mess-hall stove. When it cooled, he smuggled it and his groceries aboard the B-17 and told the CQ to wake him early.

At 0800 hours General Drew, a whip-thin man with a dyspeptic face, marched to his airplane, followed by two captains and a shapely WAF in slacks. Behind came the Operations Officer, the OD, the AO, a fireguard trundling an extinguisher, and eight APs for an honor guard. This general took off in style, thought Childs, and snapped to, saluting. "Sergeant Childs, sir, your crew chief."

The general frowned. "I know you?"

"Served with the general in Germany, sir. I know what the general wants."

"Do, hey?" The general's eyes flickered. "We'll see. Well, Chief, this is Captain Montrose, co-pilot, Captain Driscoll, navigator, and, er, this young lady here . . ."

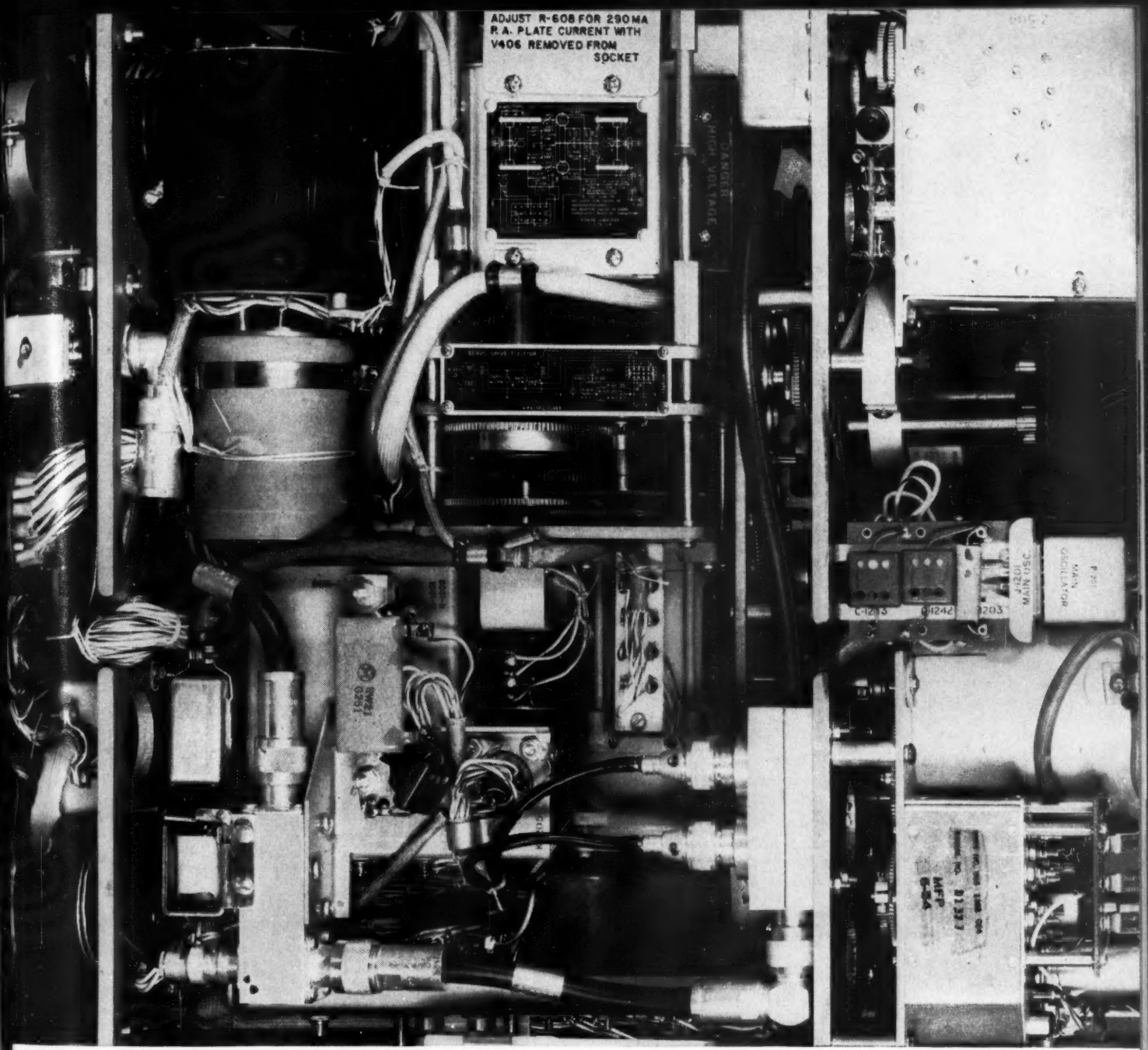
"Airman First Class Daugherty, sir," said the WAF. She was a tall, pretty girl with copper hair shining under her blue and white cap.

"Humph," said the general. "Yes, of course. Well, well, let's get this show on the road," and climbed inside, followed by the two silent captains. Childs helped the WAF into

(Continued on page 145)

ABOUT THE AUTHOR

Colonel Kay got interested in writing fiction after he received an "Operation Bootstrap" degree in 1952 from the University of Denver. Since then he's won the TAC Short Story Contest three times, and the AF-wide contest once. He's sold to Country Gentleman, Sports Illustrated, Argosy, *and* Adventure. *The 40-year-old native of Atlanta, Ga., was commissioned in 1952. He served in China and India in World War II.*



Equipment built by Delco Radio: AN/TRC 32 transportable control

AIR CONTROL...from Delco Radio

Delco Radio's outstanding record of low-cost, high-quality, on-time mass production of electronic equipment for military applications has been proved in war and in peace. With all production facilities centralized under a single roof, Delco Radio can take raw materials through to finished product for considerably less cost than ordinary assembly contractors can and still assure on-time delivery. Take advantage of Delco Radio's experienced engineering and uniquely different production facility when you need high quality units produced at lower cost.

GM GENERAL MOTORS

DELCO RADIO

DIVISION OF GENERAL MOTORS
KOKOMO, INDIANA

FREE BOOKLET OUTLINES GOOD PAYING CAREER OPPORTUNITIES FOR YOU!

Your Air Force know-how helps you move right back into a job where experience *counts*. Your prior service fits you for the job that's best for you and best for the Air Force. Find out today what the new grade determination policy can mean to you...find out what new pay and allowances you may receive by making the Air Force your career. Don't miss this opportunity to get going again on the world's finest fighting team—the U. S. Air Force.

TALK TO YOUR
LOCAL AIR FORCE RECRUITER
OR MAIL THE COUPON
TODAY FOR
YOUR FREE BOOKLET

Today and Tomorrow

You're better off in the

U. S. AIR FORCE

PASTE COUPON ON POST CARD

and mail to V-14-AFS

AIRMAN RECRUITING INFORMATION BRANCH
BOX 2202
WRIGHT-PATTERSON AFB, OHIO

Please send me more information on the Air Force Prior Service Program.

Name.....

Street..... **City**..... **Zone**.....

State..... **Year Separated**.....

the passenger compartment. Funny, the general taking a hitch-hiker.

"How far you riding with us?"

She looked puzzled "Why all the way. I'm. . . ."

"Clear prop!" barked the general, and Childs ran to stand by the fireguard. The engines stuttered, turned over, and puffed blue smoke. Bending under prop blast, Childs snatched the chocks loose and climbed aboard. Kneeling, he watched General Drew run his check-list, taxi to take-off position, and firewall the throttles. Childs nodded. This was a flying general all right.

The coastal plain puckered into hazy Appalachian ranges, and by noon they were over the Ohio Valley. With the bomb bay and Tokyo tanks the B-17 would fly non-stop to California, and it was time to go back and prepare the general's super-deluxe lunch, *a la* Sgt. Clinton P. Childs.

The WAF was on her knees, examining the galley stove. "Where does it turn on?"

Nosy female, thought Childs goodhumoredly, and showed her the master switch that cut into the main electrical system. He rotated rheostats until the burners glowed.

"Thanks," she said. "Now I need a pot to heat some water."

"Gonna do a laundry?" asked Childs, grinning.

"Laundry? I'm going to cook the general's lunch, of course." She looked mystified. "Why do you think I'm on this flight? I'm a dietician. The surgeon sent me to fix the general's meals."

"Oh, no!" cried Childs, wildly. "I cook his meals. You don't even know what he likes!"

"I know what the doctors say he has to like," she said, coldly. "Milk toast and lamb broth."

"*Milk toast*?" Childs slapped his forehead. "Milk toast for General Drew? Listen, what this general wants is some French onion soup and. . . ."

"Onion soup? You crazy or something? Now go away and quit bothering me or—oh my! What's that?"

The airplane staggered and the girl turned white. Dirty clouds streaked past, and the WAF dug her fingers into his arm. "Are we crashing?"

"Naw," growled Childs. "Just a little turbulence. Relax."

The airplane lurched and the girl turned green.

"You feeling bad?"

Her eyelashes fluttered. He ran her down the heaving corridor and pushed her into the lavatory. "Stay there," he yelled. "Safest place in the airplane," and latched the door on the outside.

That was a dirty trick, he thought, staggering to the galley. She'd be sick sure enough in the whipping tail section, but he had to get her out of the way.

Suddenly as they had hit turbulence they left it and the B-17 smoothed out. Childs got out his soup, miraculously unspilled, and spread groceries around. "Well," he thought cheerfully, "it's time for the general's lunch and she ain't here to fix it, so I guess I'll have to proceed on my own initiative like it says in the *Airman's Handbook*." Whistling, he mixed his ingredients, once or twice hearing a feeble banging from the tail section. He had the steaming soup ready to pour over croutons sprinkled with cheese just as his casserole of artichokes, sour cream, mushrooms, and chipped beef—blessed by the kiss of dry white wine—came to a simmer. "Just like the Waldorf," murmured Childs, and went forward to tap the general's shoulder. "Lunch, sir!"

The general snorted. "Infantile pap, you mean." He gave the controls to the co-pilot and followed Childs into the passenger compartment. When he saw the soup he blinked.

"Bless me! The surgeon prescribe this?" His nostrils twitched. "Smells delicious." He sat down, shook out his napkin and tasted. "Delightful!" He drank the soup quickly and Childs uncovered the smoking casserole of artichokes and beef. The general chortled. "Magnificent! Where's that girl, hey?"

A terrific banging broke out. Childs gulped. "Door must have jammed on her, sir." He ran back and turned the latch. Airman Daugherty, eyes blazing, copper hair disheveled, pushed past him.

"What do you mean, locking me in . . .? Oh! General Drew!"

The general smiled. "It is a new dish to me," he said, "but a noble one."

Childs grinned triumphantly. The girl gasped. "Artichokes? How do you feel, sir?"

"Splendid!" The general beamed. "First meal in months hasn't given me cramps. I told those medical idiots all I needed was decent food."

Sergeant Childs smirked.

"No cramps at all, sir?" asked the WAF doubtfully.

"Not a sign," said General Drew. "Distinguished cooking best medicine after all, eh?" He wiped his mouth, rose and patted her shoulder. "Congratulations, young lady. You're an inspired cook."

Childs's jaw dropped.

The general looked regretfully at his unfinished casserole. "Here, Chief, finish it for me. Food for the gods, my boy."

"But, sir!"

"Now, now. You won't find food like that every day. My compliments, young lady." Smiling, he went forward.

"Go on, Sergeant," said the girl. "You heard the man. Eat it."

"I ain't hungry," he snarled, and stalked away. This had torn it. Damn women in uniforms. Damn women in airplanes. Damn women anyway.

Frustrated and sulky, he flipped the pages of magazines. Frustrated and sulky, he watched green prairies fade into dun-colored plains, eroded and barren. Barren as his future.

She touched his shoulder, smiling at him under that sorrel hair. For the first time he really saw her and in spite of himself reacted to the red mouth and solid flesh on good bones.

"I'm still mad at you," she said, "but I ate your artichokes and I'm not nearly as mad as I was. Besides, I'm dying of curiosity. Tell me how a crew chief ever learned to cook like that and what it's all about anyway, and maybe I'll forgive you. I'm a dietician, but I can't cook the way you do."

Childs grunted. She wasn't so bad after all. Good looks, good tastes, discriminating palate. "Well," he said, "the damage is done, but I might as well tell you. There was this Maqui named Alphonse . . ."

By the time he finished they were flying into a late Colorado sun and calling each other Sally and Clint. "Clint," she said, softly, "that's a beautiful story. I'm going to tell the general the truth."

He sat up alarmed. "Don't you do it! You want him to know I locked you in the can? You want him to find out what the doctor really prescribed? You want him to know I might have poisoned him and that he made a mistake and congratulated the wrong cook? Leave it lay, Sally! Never volunteer information to generals. They know everything already, and it hurts their feelings to find out they're wrong."

"But you've got a right to be a cook," she insisted. "It's your calling."

He sniffed suddenly, and sprang like a released catapult. "Put out that cigarette!"

"What?"

(Continued on following page)

The Electronic Highroads to new industrial wealth

Since the vision of Du Mont opened the new Electronic Age, the imagination of all industry has turned toward electronics for competitive advantage and unlimited progress.

The astonishing flexibility, cost-saving speed and microscopic precision of electronic applications now permit efficient use of new materials, machines, fuels and methods . . . for better products, made to sell profitably at practical prices. These greater industrial values benefit industry and consumer alike!

Du Mont's long experience in electronics for industry, science, national defense and the home is now available to create the finest electronic tools and precision production systems . . . invaluable savers of time and cost for every industrial operation.

ENGINEERS—The Allen B. Du Mont Laboratories offer an atmosphere of achievement for successful careers. Our employment manager at 750 Bloomfield Ave., Clifton, N. J., welcomes inquiries.

VISION is the DU MONT DIMENSION

FIRST WITH THE FINEST IN TELEVISION

RESEARCH • COMMUNICATION PRODUCTS • CATHODE-RAY TUBES • INSTRUMENTS • DEFENSE EQUIPMENT • TELEVISION RECEIVERS • RADIOS AND HI-FI

Allen B. Du Mont Laboratories, Inc., Executive Offices, 750 Bloomfield Avenue, Clifton, N. J. West Coast Office: 11800 West Olympic Blvd., Los Angeles 64, Calif.

CREW CHIEF——CONTINUED

"Gas fumes! We've got a leak somewhere. Here, put this on, quick!" He threw her a parachute and darted forward.

Sally panicked. Raw gasoline stung her nostrils and she fumbled with the stiff 'chute harness while cold fear spread in her stomach. The general came back, sniffing like a bird dog. "Bomb bay tank, I should say. Tighten that girl's 'chute and brief her on escape procedure. Then get forward."

The WAF trembled. Childs adjusted her harness and patted her shoulder. "Don't worry," he said, quietly. "We've got a little trouble, but there's a base only ten minutes away we're heading for. If that bell sounds, though, pull this yellow handle and go out head first. Got it, Sally?"

She tried to smile. "Got it, Clint."

He raced forward, putting on his own 'chute as he went.

The general had declared an emergency and gone off the air. He cut his batteries and generators while the co-pilot strained his eyes against blinding, sunshot dust, and the navigator computed time and distance by the sweep hand of his watch. Childs crouched and sweated.

The tawny dust thinned and a white geometry of runways sprang out ahead. "Going straight in," murmured the general, and cut his batteries in. At his slashing gesture the co-pilot dropped wheels and flaps and they slowed abruptly. Over-run markers flashed beneath, then oil-stained concrete, and with a screech the tires took hold. Firetrucks and an ambulance raced them while the general tapped his brakes and they came to a quivering halt.

Childs ran aft, kicked the hatch open and pushed Sally out. "Run!" he commanded. "This thing can still blow," and dragged her to the shelter of the ambulance while the firetrucks herded in, foam nozzles tracking like antennae.

A staff car with a checkered line flag drove up and a white haired brigadier general jumped out to shake General Drew's hand. "Nice to see you, Frank," he drawled, "but I kind of sweated you down. Why don't you turn that clunk in on a good airplane?"

"Glad to be here, Jack," said the general. "She's still a good airplane. Got a fine galley, anyway." He turned to Captain Montrose. "Call me at General Braxton's quarters when you've got her back in commission."

"Stay for dinner, Frank," said General Braxton. "I'm batching this week,

(Continued on page 149)

ENGINEERS ARE V.I.P.'S AT AGT*

...an engineer is indeed a "Very Important Person" at the GE Propulsion Center in Cincinnati... a professional with responsible work to do...and a clear path of advancement before him

The management at AGT* does not — in fact — go around every day proffering bouquets or hanging medals on its engineers (although 40 awards for outstanding engineering achievement were made here last year)—but the picture above genuinely reflects the company's attitude toward its professional staff.

AGT would as soon think of limiting a graduate engineer to routine operations and board work as of hitching *Nashua* to a hay wagon. Here an engineer takes full responsibility for some phase of engine development, requisitioning materials and tests he needs on his own authority.

He is free to choose his technical field, to shift it, if his interests change, to concentrate on technical specialization, or train for managerial work. Courses, counselling, contact with top men, a Full Tuition Refund Plan for advanced study, are all provided to aid him advance. Promotion matches personal progress. Salaries are high.

The engines designed and produced at AGT are among the most highly engineered products in the world. The men who develop them earn a high place in their profession. It is the emphasis here on creative thinking, and professional responsibility coupled with respect for the status of the engineer, that has made it all possible.

IMMEDIATE OPENINGS NOW FOR GRADUATE

ENGINEERS • MATHEMATICIANS PHYSICISTS • METALLURGISTS

... with 1 to 5 years experience

Rocket Engine Design and Development • Mechanical Design Testing and Evaluation of New Aircraft Engines, Rocket Motors, and Components • Development of Fuels and Combustion Systems for Future Jet and Rocket Engine Types • Numerical Analysis and Programming, using IBM 704 and Associated Equipment • Facilities and Testing Equipment Design • High Temperature Metallurgical Processes Development • Aerodynamic and Thermodynamic Design and Analysis • Manufacture and Testing of Demonstrator, Prototype, and Production Engines • Nuclear Applications in Jet and Rocket Engines • Product Application and Marketing

If you have it in you to be a V.I.P. in this GE Division, please contact us for details.

Write to: Mr. S. Bell, Aircraft Gas Turbine Division

***AIRCRAFT GAS TURBINE DIVISION**

GENERAL ELECTRIC

CINCINNATI 15, OHIO

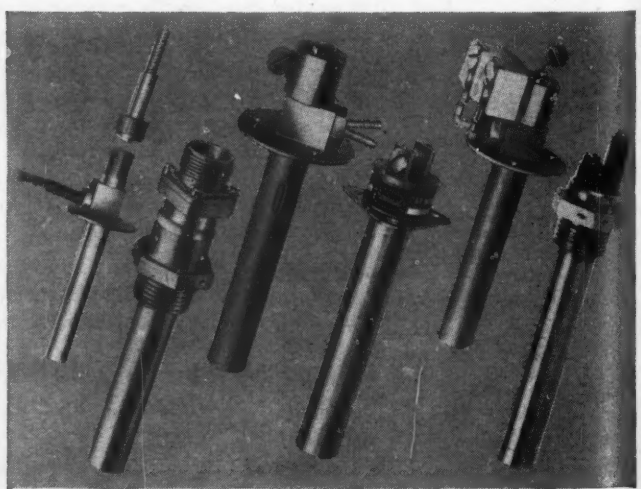
THE FAIRCHILD FLYING BOX CAR uses four Fenwal THERMOSWITCH controls in each of its eight combustion heaters for Lead Edge De-icing. Two of the THERMOSWITCH Heater Controls are set at 410°F for cycling and two are set at 490°F for over-heat protection. These Fenwal controls are located just outside the end of the heater in the pipe that connects the heater with the duct.

FENWAL HEATER AND VENTILATING CONTROLS ASSURE FLYING SAFETY AND COMFORT

THE GLOBE-GIRDLING DOUGLAS DC-7 assures its passengers a safe, comfortable ride with Fenwal THERMOSWITCH® Heater Controls. Fenwal controls maintain a steady, comfortable temperature in passenger and crew cabins. The anti-icing heater of the DC-7 is equipped with primary and secondary cycling and over-heat THERMOSWITCH units. Fenwal rate-of-rise THERMOSWITCH units are located in the duct off the main cabin heater.

THE NEW CONVAIR 440 "METROPOLITAN" depends upon Fenwal THERMOSWITCH Heater Control devices as cycling thermostats and over-heat controls on its cockpit heater and in the exhaust augmentor control vanes. Highly resistant to shock and vibration, compact Fenwal THERMOSWITCH units meet the vigorous temperature control requirements that this plane encounters over its serviced routes throughout the world.

In many of America's leading aircraft, safety and comfort are assured by Fenwal Heater and Ventilating Controls. These dependable Fenwal units are built to withstand the extremely high temperatures of modern aircraft under widely varying conditions of atmosphere, vibration and shock in accordance with applicable military and government specifications.



GET FENWAL HEATER CONTROL DEVICES. There are Fenwal units for all types of aircraft. The outer shell is the temperature sensitive element that actuates internal contacts the instant surrounding air reaches the set point. Write for complete data to **Fenwal Inc., Aviation Products Division, 343 Pleasant Street, Ashland, Massachusetts.**

Fenwal Controls Temperature ... *Precisely*

but they lay on a nice spread at the club."

"Speaking of dinner," said General Drew, "I had a wonderful lunch today. Those fool doctors have had me. . . ." The staff car drove away.

They dropped Sally at the transient lounge and went into the base flight hangar. A white-coveralled alert crew was probing the B-17's midsection and a bald, worried-looking lieutenant spoke to Childs. "Found your trouble, Chief. Seal shot in the fuel selector valve."

"Your service stock got a replacement?"

"Not for any B-17," he said. "Priorities are calling Ogden, but even if they've got one it'll be tomorrow before it's here."

"Listen," said Captain Montrose, coming up in time to overhear him. "Our general's got to be in San Francisco in the morning."

"He won't make it in this airplane," said the lieutenant dolefully.

"Hell," said Montrose, looking dismal. "I better call him."

Childs examined the valve assembly. "If you had a seal I could fix this."

"No seal," said the maintenance officer, flatly. "Not for that valve. Listen, I'm sorry about this. I don't want General Braxton chewing me out for grounding you people. He can get awful tough, that general."

"Can't they all?" said Childs, sympathetically.

Captain Montrose returned, swearing. "General Drew said if this thing wasn't airworthy tonight we could all start looking for new jobs."

Childs turned the selector valve over in his hand, remembering. "We had trouble like this in England once," he said slowly. "I was a gunner then, but I remember something the mechanics did. They took a neoprene seal and micrometerd it to fit and. . . . You got any seals in your hydraulic shop, lieutenant?"

A gum-chewing kid airman tugged his sleeve. "Some dame wants you on the horn, Sarge. Over there on the work bench."

"What dame?" growled Childs. "I don't know no women here."

The chewing gum popped. "Don't ask me, Dad. I ain't no Quiz Kid. All I know is she asked for you."

The bald lieutenant was staring at him. "You can have every seal in the shop, Chief, if you think they'll help. I'll go get them myself."

Childs nodded and answered the phone. "Oh, Clint!" said Sally. "I'm

(Continued on page 151)

marquardt *Announces*
A NEW PROGRAM OF
INDIVIDUAL PROFESSIONAL DEVELOPMENT
for our Engineers

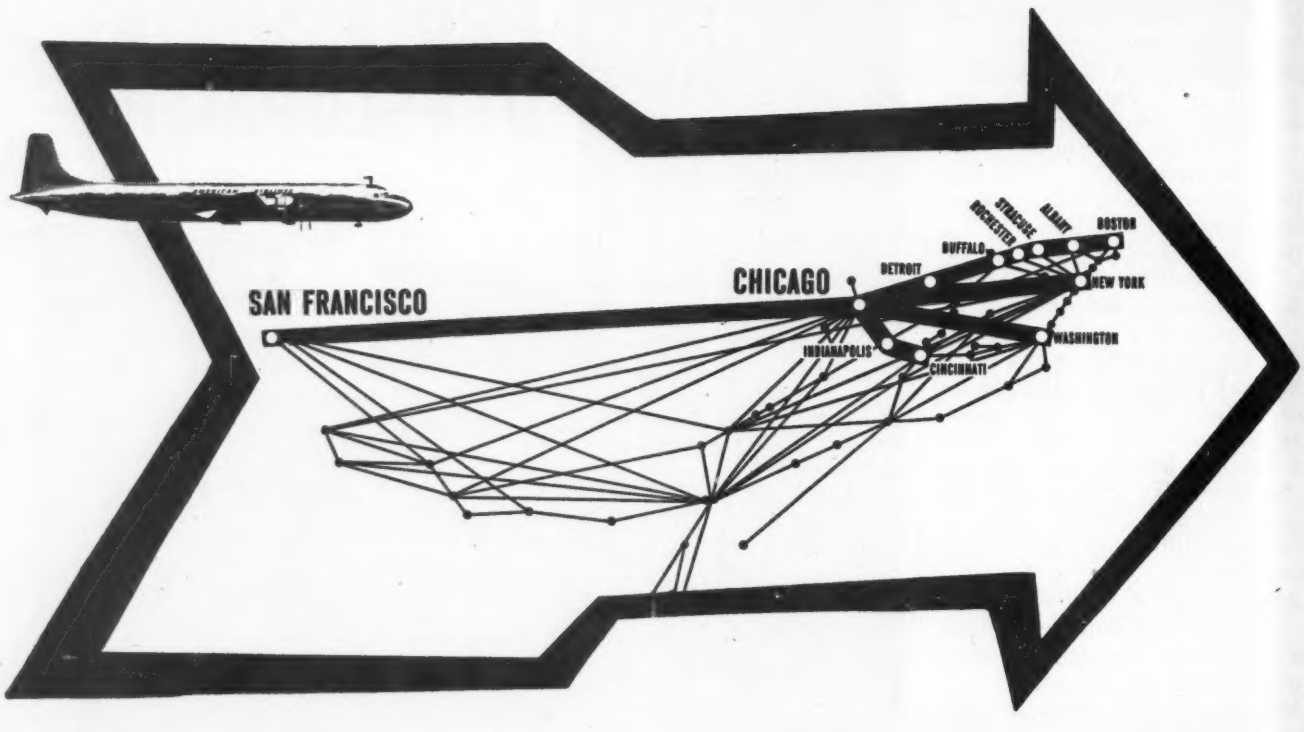
Individual guidance for you by outstanding specialists complemented by company-supported educational programs. Write for details

marquardt AIRCRAFT CO.

Attention: Professional Personnel
Industrial Relations Department • 16557 Saticoy St., Van Nuys, Calif.
THE WEST'S LARGEST JET ENGINE RESEARCH AND DEVELOPMENT CENTER

FLY AMERICAN'S
NEW ROUTE NONSTOP

SAN FRANCISCO
CHICAGO



ON THE DC·7 - WORLD'S FASTEST AIRLINER

Now—for the first time—travelers can fly America's leading airline between Chicago and San Francisco. They can fly nonstop aboard the luxurious DC•7—world's fastest airliner. Relax in the roomy comfort of a club-chair seat and enjoy the congeniality of the spacious lounge. Truly the finest service between the Bay Area and the Midwest!

AMERICAN AIRLINES

America's Leading Airline

in the awfullest mess! You've got to help me."

"What mess?" he asked sourly. "Where are you?"

"In General Braxton's kitchen," she cried, consternation in her voice. "It's just awful, Clint. General Drew's bet ten dollars I can cook them a better meal than General Braxton's cook at the club. Oh Clint, what am I going to do?"

Childs roared with hard, derisive laughter. "Give them milk toast and lamb broth!"

The lieutenant came out of the hydraulic shop and handed Childs a micrometer, a selection of seals, and a tool box. Childs nodded his thanks and waved him away. Served this redhead right, he thought joyfully, lousing up the general's lunch.

"Oh, Clint," she said reproachfully, "help me please. This is terrible."

Suddenly he softened. It wasn't her fault. "Listen, Sally, don't panic. You do what I say and you can give those generals a dinner worth more than any ten-dollar bet. Keep the line open and stand by." He turned to the maintenance officer. "Sir, I need a driver to take a bag out of the airplane up to General Braxton's quarters. He's to take it around to the back door. Okay, sir?"

"Sure," said the lieutenant. "Anything you want, Chief. Just get this crate in commission."

Childs set to work on the valve. In a few minutes Sally called him back. "Your grocery store just arrived, Clint. What do I do now?"

Measuring the worn-out seal, he contemplated his stock of provisions. "Tell you what, Sally. Let's give those generals something hearty and special, but something you won't have too much trouble with. How about a huacamole salad and my particular Beef Stroganoff?"

"I never heard of them," she wailed. "But I'm game, chef. Start talking."

He chuckled. "Relax. It's a breeze. Peel that avocado and mash it up with some chopped olives and use lettuce leaves for a base. Hold it a second—dropped my screwdriver. By the way, I'm fixing the airplane, too. How about having dinner in Frisco with me tomorrow?"

She laughed, a warm laugh that made him tingle. "You're giving the orders, Sergeant."

"Okay. For dressing use five parts of olive oil to one of tarragon vinegar and squeeze in a lime. And add three drops of tabasco. Do that and report back."

Whistling tunelessly he shaped and fitted the new seal. Sally came back to the telephone. "Now," said Childs, "pound that beef fillet thin and slice it in inch strips. Start a chunk of butter melting, grate in a garlic kernel and a dash of Worcestershire, and take the basil and sour cream and those left-over mushrooms and. . . ."

Half an hour later, after warning Sally to crumble the sharp cheddar and how much cayenne to use on the cold mashed potatoes scrounged from General Braxton's refrigerator, Childs handed the maintenance officer a rebuilt valve assembly. "Lemme finish talking to this woman here, sir," he said, confidentially, "and I'll help your crew install it."

The lieutenant wagged his head admiringly. "Take your time, Chief. You've earned it."

"Now, baby," continued Childs to the telephone, "stuff that Stroganoff and huacamole down the old goats and we're off for Cali—"

"What the devil is this?" demanded General Drew's icy voice on the telephone.

"Little, uh, confusion, sir," croaked Childs, signaling desperately for Captain Montrose. "Co-pilot trying to report on the airplane's status, sir. Here you are, sir." He thrust the instrument into Montrose's hand, wincing at the crackle of the general's voice at the other end of the line.

"Yes sir, yes sir," stammered Montrose. "But the aircraft's fixed, sir. Sergeant Childs—yes sir, he did. He fixed the selector valve, and we can take off whenever you like. Cooking dinner over the telephone? What's that you said, sir?" His eyebrows queried Childs frantically.

Both of them heard General Braxton's booming baritone. "Frank, you damn fool, put down that phone and come eat. You've won your bet hands down!"

• • •

"So now you're the general's regular crew chief, huh?" asked Master Sergeant Oldham. "Looks like you're stuck in maintenance after all."

"Well, I cook for him on flights, too," said Childs.

"Humph," snorted Oldham. "Thought you didn't have no time for women either. Who's that redheaded WAF you're running around with?"

Childs grinned. "Aw, she's my star pupil."

"Pupil?"

"Yeah," said Childs. "When we ain't flying, I run a cooking school for the hospital dieticians. General Drew's orders, Sarge."—END

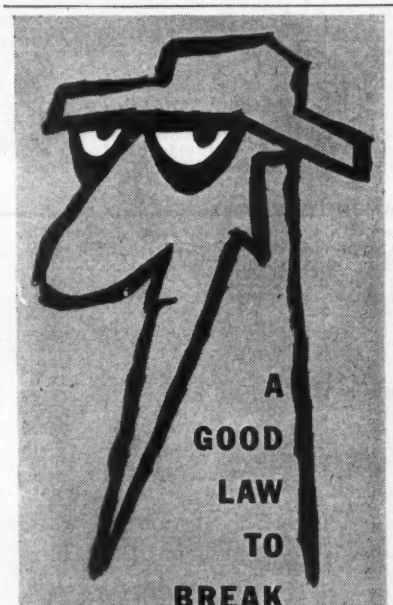
Airport Space and Facilities

BLYTHE AIR BASE
CALIFORNIA

Ideal for the manufacture, test, maintenance, modification, repair or storage of; aircraft, aircraft components, armament, guided missiles, drones, jet engines, rockets.

Five thousand acres isolated from populous regions, four runways of seven thousand feet in length, which can be readily expanded, large parking aprons, operational buildings & hangars. Write or phone for full particulars.

BLYTHE AIRCRAFT CORPORATION
P. O. Box 191, Alhambra, California
CUmberland 3-2181



A GOOD LAW TO BREAK

The law of averages says that cancer will kill one out of every six Americans. But the law does not have to prevail. You can help break it in two ways. By having a thorough medical checkup every year . . . and by sending a contribution to your Unit of the American Cancer Society or to Cancer, c/o your town's Postmaster.

Fight cancer with a checkup and a check.

AMERICAN CANCER SOCIETY

THIS IS AFA

The Air Force Association is an independent, non-profit, airpower organization with no personal, political or commercial axes to grind; established January 26, 1946; incorporated February 4, 1946.

OBJECTIVES

• To assist in obtaining and maintaining adequate airpower for national security and world peace. • To keep AFA members and the public abreast of developments in the field of aviation. • To preserve and foster the spirit of fellowship among former and present personnel of the United States Air Force.

MEMBERSHIP

Active Members: Individuals honorably discharged or retired from military service who have been members of, or either assigned or attached to the USAF or its predecessor services, or who are currently enrolled in the Air Force Reserve or the Air National Guard. $5.00 per year.

Service Members (non-voting, non-office holding): Military personnel now assigned or attached to the USAF. $5.00 per year.

Cadet Members (non-voting, non-office holding): Individuals enrolled as Air Force ROTC Cadets, Civil Air Patrol Cadets, or Cadets of the US Air Force Academy. $3.00 per year.

Associate Members (non-voting, non-office holding): Individuals not otherwise eligible for membership who have demonstrated their interest in furthering the aims and purposes of the Air Force Association. $5.00 per year.

Industrial Associates: Companies affiliating with the Air Force Association on a non-membership status that receive subscriptions to AIR FORCE Magazine and special magazine supplements know as Industrial Service Reports.

OFFICERS AND DIRECTORS

GILL ROBB WILSON, President
366 Madison Ave.
New York 17, N. Y.

JULIAN B. ROSENTHAL, Secretary
630 Fifth Ave.
New York 20, N. Y.

SAMUEL M. HECHT, Treasurer
The Hecht Co.
Baltimore 1, Md.

JOHN R. ALISON, Chairman of the Board
c/o Northrop Aircraft, Inc.
Hawthorne, Calif.

Regional Vice Presidents: Thomas C. Stebbins, 66 Uxbridge St., Worcester, Mass. **(New England)**; Randall Leopold, Box 150, Lewistown, Penna. **(Northeast)**; Charles W. Purcell, 1102 N. Charles St., Baltimore 1, Md. **(Central East)**; Alex G. Morphonios, 3131 NW 16th St., Miami, Fla. **(Southeast)**; Glenn D. Sanderson, 44 Capital Ave., NE, Battle Creek, Mich. **(Great Lakes)**; Edwin A. Kube, 4516 42d Ave. South, Minneapolis, Minn. **(North Central)**; Frank T. McCoy, Jr., Powell Ave., Nashville 4, Tenn. **(South Central)**; J. Chesley Stewart, 1423 Locust St., St. Louis 3, Mo. **(Midwest)**; Clements McMullen, 515 Lamont Ave., San Antonio 9, Tex. **(Southwest)**; Wm. Thayer Tutt, Broadmoor Hotel, Colorado Springs, Colo. **(Rocky Mountain)**; Winfield G. Young, 2039 E. 103 St., Seattle 55, Wash. **(Northwest)**; Cecil C. Howard, 359 N. Los Robles, Pasadena 4, Calif. **(Far West)**; Roy J. Leffingwell, P. O. Box 2450, Honolulu, T. H. **(Pacific Ocean Area)**.

Directors: George A. Anderl, 412 N. Humphrey Ave., Oak Park, Ill.; **Walter T. Bonney,** 9414 St. Andrews Way, Silver Spring, Md.; **Thomas D. Campbell,** 323 Third St., SW, Albuquerque, N. M.; **Beulah M. Carr,** President, National Ladies Auxiliary, 5346 N. Ludlam Ave., Chicago, Ill.; **John J. Currie,** 175 E. Railway Ave., Paterson, N. J.; **Edward P. Curtis,** 343 State St., Rochester 4, N. Y.; **James H. Doolittle,** 50 W. 50th St., New York, N. Y.; **Merle S. Else,** 2127 E. Lake St., Minneapolis 7, Minn.; **George D. Hardy,** 3403 Nicholson St., Hyattsville, Md.; **John P. Henebry,** Box 448, Park Ridge, Ill.; **Robert S. Johnson,** 235 S. Brixton Road, Garden City, L. I., N. Y.; **Arthur F. Kelly,** 6060 Avion Drive, Los Angeles 45, Calif.; **George C. Kenney,** 23 W. 45th St., New York, 36, N. Y.; **Thomas G. Lanphier, Jr.,** 3165 Pacific Highway, San Diego 12, Calif.; **W. Barton Leach,** 295 Meadowbrook Road, Weston, Mass.; **Carl J. Long,** 1050 Century Bldg., Pittsburgh 22, Penna.; **James H. McDivitt,** 7461 Kenton Drive, San Gabriel, Calif.; **Dr. Jerome H. Meyer,** 880 Fidelity Bldg., Dayton, Ohio.; **Msgr. William F. Mullally,** 4924 Bancroft Ave., St. Louis 9, Mo.; **Gil Petrina,** National Commander, Arnold Air Society, Univ. of Md., College Park, Md.; **Mary Gill Rice,** 18 Tapia Dr., San Francisco, Calif.; **Peter J. Schenk,** Meadows End, N. Gage Rd., Barneveld, N. Y.; **C. R. Smith,** Apt. 4-A, 510 Park Ave., New York 22, N. Y.; **Carl A. Spaatz,** 1654 Avon Place, NW, Washington, D.C.; **Thomas F. Stack,** Central Tower, San Francisco 3, Calif.; **Harold C. Stuart,** Suite 1510, Nat'l Bank of Tulsa Bldg., Tulsa, Okla.; **T. F. Walkowicz,** Suite 5600, 30 Rockefeller Plaza, New York 20, N. Y.; **Frank W. Ward,** 257 Lake Shore Dr., Battle Creek, Mich.; **Morry Worshill,** 2223 Highland Ave., Chicago 45, Ill.

WING COMMANDERS

Thomas E. Bazzarre, Jr., Beckley, W. Va.; Girard A. Bergeron, Warwick, R. I.; W. P. Budd, Jr., Durham, N. C.; Philipe Coury, Readville, Mass.; Stanley Denzer, Brooklyn, N. Y.; Leonard Dereszynski, Milwaukee, Wis.; Irvin F. Duddleson, South Bend, Ind.; Roland E. Frey, Webster Groves, Mo.; Joseph Gajdos, E. Rutherford, N. J.; Arthur L. Gordon, Honolulu, T. H.; Frederic P. Goulston, Dayton, Ohio; William H. Hadley, Little Rock, Ark.; Harold R. Hansen, Seattle, Wash.; Arland L. James, Albuquerque, N. M.; George James, Daytona Beach, Fla.; William G. Kohlan, Minneapolis, Minn.; William F. Kraemer, Springfield, Va.; Robert N. Maupin, Cheyenne, Wyo.; Robert H. Mitchell, Portland, Ore.; Charles O. Morgan, San Francisco, Calif.; Stanley Mull, Benton Harbor, Mich.; Charles P. Powell, Mobile, Ala.; F. O. Rudesill, New Orleans, La.; George Van Leeuwen, Ogden, Utah; Donald P. Spoerer, Chicago, Ill.; Herbert Stockdale, Colorado Springs, Colo.; Ernest Vandiver, Atlanta, Ga.; John S. Warner, Towson, Md.; Frank W. Wiley, Helena, Mont.; Leonard Work, State College, Penna.; Glenn Yaussi, Lincoln, Nebr.

COMMUNITY LEADERS

Akron, Ohio, James D. Wohlford, 1740 16th St., Cuyahoga Falls; **Albany, N. Y.,** Walter H. Taylor, Dutch Village, Meanands; **Atlanta, Ga.,** Joel B. Paris, 2452 Ridgewood Rd., NW; **Altoona, Pa.,** George Knab, 719 1st Ave.; **Arlington, Mass.,** Richard Carter, 147 Jason St.; **Baltimore, Md.,** William Reber, 335 E. 27th St.; **Bangor, Me.,** Martin Cantor, 312 French St.; **Baton Rouge, La.,** George Dean, P.O. Box 2454; **Battle Creek, Mich.,** Oscar W. Brady, 14 Douglas St.; **Boston, Mass.,** E. L. Shuman, 1625 Commonwealth Ave., Brighton; **Brooklyn, N. Y.,** Joseph Grieco, 353 36th St.; **Cheyenne, Wyo.,** Donald Hefkin, 508 E. 25th St.; **Chicago, Ill.,** Donald Spoerer, 1442 W. 83d St.; **Chicopee, Mass.,** Raymond J. Tomchik, 104 Granville Ave.; **Cincinnati, Ohio,** Dean S. Rood, 4009 Lansdowne Ave.; **Clearfield, Utah,** Don Hartley, P.O. Box 114; **Cleveland, Ohio,** O. M. Fike, 22370 Coulter; **Colorado Springs, Colo.,** Herbert Stockdale, 318 N. Farragut; **Dayton, Ohio,** Jack Jenefsky, 1428 Benson Dr.; **Daytona Beach, Fla.,** Arch Yelvington, 139 S. Oleander Ave.; **Dearborn, Mich.,** Richard Porch, 8221 Manor, Detroit; **Detroit, Mich.,** Victor Modena, 12420 Stoepel; **Elgin, Ill.,** Ray McGaughey, 1166 Logan Ave.; **Enid, Okla.,** Clyde Dains, 430 S. Van Buren; **Fairfield, Calif.;** Richard Rowe, 1406 Clay St.; **Flint, Mich.,** Ross Robinette, 4026 Donnelly; **Fort Worth, Tex.,** Jerry W. Davidson, 2437 Medford Court; **Fresno, Calif.,** Walter Willms, 1229 Linden Ave.; **Grand Rapids, Mich.,** Edward White, 2726 Albert Dr., S.E.; **Hagerstown, Md.,** C. F. Barclay, P.O. Box 333; **Harrisburg, Penna.,** Robert Green, 4136 Ridgeview Rd., Colonial Park; **Hawthorne, Calif.,** James F. Czach, P. O. Box 524; **Hollywood, Fla.,** A. A. Wittenstein, P. O. Box 635; **Honolulu T. H.,** William Saunders, P. O. Box 1618; **Houston, Tex.,** Robert B. Thieme, 5414 Kleberg; **Jackson, Mich.,** Keith L. Hall, 1314 Rhodes St.; **Kansas City, Kan.,** Frederick Betts, 400 E. Donovan Rd.; **Kenosha, Wis.,** Dale G. March, Rt. 4, Box 655; **Knoxville, Tenn.,** Laurence Frierson, c/o Hamilton Nat'l Bank; **Lake Charles, La.,** L. R. Savoie, Gordon Bldg.; **Lansing, Mich.,** Richard Taylor, 3010 Westwood Ave.; **Leesburg, Fla.,** Brad Hester, 1101 Lee St.; **Lewistown, Pa.,** Max Flemming, 46 Spanogle Ave.; **Lexington, Mass.,** Harold E. Lawson, RFD; **Lincoln, Nebr.,** Walter Black, 726 Stuart Bldg.; **Long Beach, Calif.,** Ernest Dunn, P.O. Box 8126; **Los Angeles, Calif.,** William Barcoff, 4257 Strohm, N. Hollywood; **Madison, Wis.,** Edward J. Lottes, 405 Stone Terrace; **Marietta, Ga.,** Joseph A. Sellars, 401 S. Woodland Dr.; **Miami, Fla.,** Ted Koschler, 10803 NE 9th Ave.; **Miami Beach, Fla.,** John Peterson, 4881 Lake Dr. Lane, So. Miami; **Millington, N. J.,** H. B. Venn, Jr., Gillette Rd.; **Milwaukee, Wis.,** Leonard Dereszynski, 2922 S. 13th; **Minneapolis, Minn.,** Leonard Stevens, 5493 Erickson Rd., New Brighten; **Mobile, Ala.,** Robert Ely, 2030 Ellen Dr.; **Modesto, Calif.,** Zenas Hanson, 625 Reno Ave.; **New Haven, Mo.,** D. D. Borcherding; **New Orleans, La.,** Clyde Hailes, 5218 St. Roch; **New York, N. Y.,** Stanley C. Denzer, 1086 Ocean Ave., Brooklyn; **Ogden, Utah,** Marvin Fischer, 541 23d St.; **Oklahoma City, Okla.,** Mace Spangler, 2500 NW 28th St.; **Omaha, Nebr.,** J. H. Markel, Jr., 6001 Military Ave.; **Pasadena, Calif.,** Ozro Anderson, 439 N. Catalina Ave.; **Philadelphia, Pa.,** Frank Stieber, 620 S. 56th St.; **Phoenix, Ariz.,** B. F. Foote, Jr., 2310 E. Yale; **Pittsburgh, Pa.,** Robert L. Carr, 1227 Chelton; **Portland, Ore.,** Glenn Currey, 3715 N. Longview Ave.; **Sacramento, Calif.,** Carson Sheetz, 2929 Fulton Ave.; **St. Joseph, Mich.,** Ralph A. Palmer, 2522 Thayer Dr.; **St. Louis, Mo.,** Wallace G. Brauks, 4927 Wise Ave.; **San Antonio, Tex.,** William Bellamy, 200 Tuttle Rd.; **San Diego, Calif.,** Jim Snapp, 3425 Udal St.; **San Francisco, Calif.,** Bob Begley, 1763 22nd Ave.; **San Juan, P. R.,** Jose Rivera, 207 Jose de Diego St., Rio Piedras; **Santa Monica, Calif.,** Theodore Stonehill, 2937 Motor Ave.; **Savannah, Ga.,** Andrew Swain, 1931 Grove St.; **Seattle, Wash.,** James R. Nelsen, 11027 Meridian; **Skokie, Ill.,** Robert Vaughan, 8303 N. Monticello Ave.; **South Bend, Ind.,** Paul Moyer, 618 E. Washington; **Springfield, Mo.,** Carl J. Benning, 523 Woodruff Bldg.; **Stockton, Calif.,** Dean Williams, 1627 West Lane; **Syracuse, N. Y.,** J. William Lowenstein, 1026 Westcott St.; **Tampa, Fla.,** Bill Byron, 4515 Sevilla; **Taunton, Mass.,** Robert Ramsay, 12 Annawan St.; **Toledo, Ohio,** Jack Sperling, 709 Independence; **State College, Pa.,** John Fox, RFD #1; **Van Nuys, Calif.,** Jay Jester, 15915 Hartland; **Washington, D. C.,** Donald Steele, 224 Monroe St., Falls Church, Va.; **West Palm Beach, Fla.,** Edw. L. Johannes, 628 Forest Hills Blvd.; **Worcester, Mass.,** Charles Cashen, 4 Othello St.; **Yakima, Wash.,** Henry Walker, 6403 Summitview Ave.

NATIONAL HEADQUARTERS STAFF

Executive Director: James H. Straubel

Assistant for Reserve Affairs: Edmund F. Hogan

Program Director: Ralph V. Whitener

Assistant for Special Events: Herbert B. Kalish

Organization Director: Gus Duda

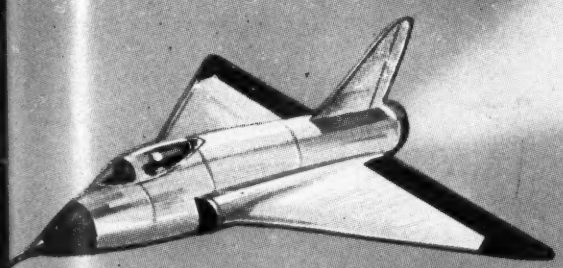
Bendix Products Division

A DEPENDABLE SOURCE

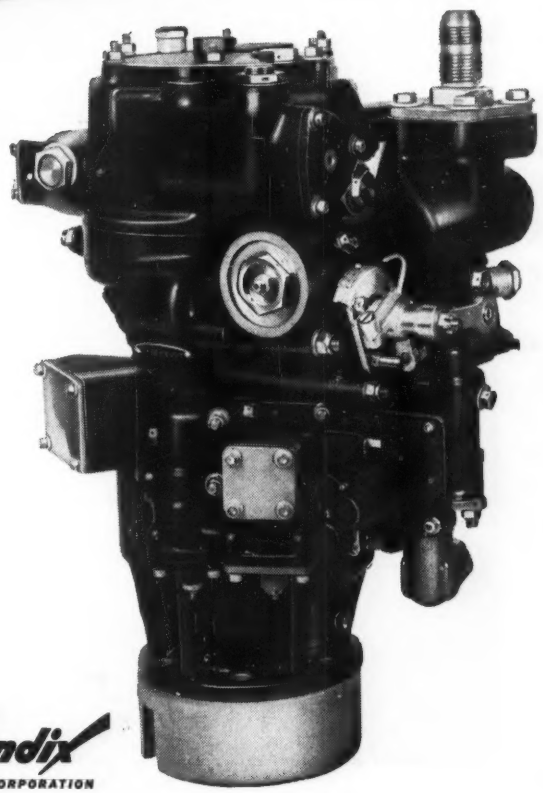
FOR CREATIVE ENGINEERING AND QUALITY MANUFACTURING

BENDIX Products Division has long specialized in FUEL METERING, ENGINE CONTROL SYSTEMS and LANDING GEAR.

SERVING ALMOST ALL American airframe and engine manufacturers, Bendix can bring much of the COMBINED KNOW-HOW OF THE INDUSTRY to the benefit of any one project.



FOR EXAMPLE...



This advanced type fuel metering unit was developed by Bendix to include special features for the 10,000-pound thrust class Pratt & Whitney J-57 turbojet—the engine which puts the power behind the super performance of the F4D Skyray.

As early as 1945, Bendix brought out a jet engine control which automatically metered fuel during engine acceleration and deceleration so as to avoid over-temperature, compressor stall and "flame out". Since then, these features have become a "must" on all jet engine controls, allowing the pilot to slam the throttle wide open without danger of ruining the engine, or slam it shut without risk of "flame out".

Bendix fuel metering is used today on nearly all American airliners, and on a great majority of military aircraft. This includes injection type carburetors and direct fuel injection, as well as fuel metering and complete engine control systems for jets.

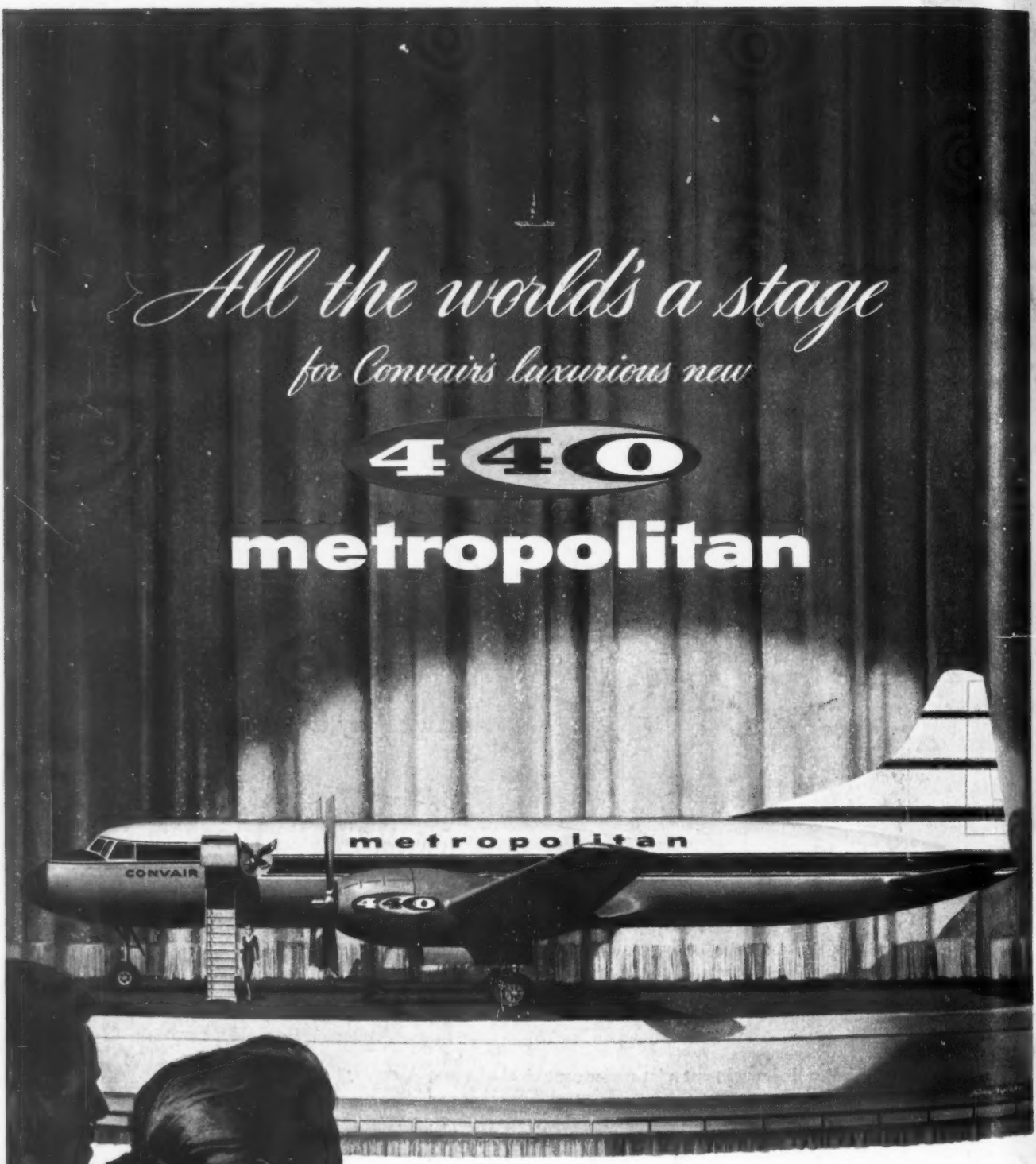
These and other achievements are solid evidence that the aircraft industry can continue, as in the past, to look to Bendix for creative engineering and quality manufacturing.

Float and injection type carburetors . . . Direct injection fuel systems . . . Fuel metering and engine control systems for jets and turboprop engines . . . Brakes, wheels and shock absorbing struts for all types of airplanes.

BENDIX PRODUCTS DIVISION SOUTH BEND INDIANA

Bendix AVIATION CORPORATION

Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.



Soon to fly on leading airlines throughout the world,
Convair's new METROPOLITAN 440 offers you more *luxury!*
More *speed!* And the *quietest* passenger cabin of *any* airliner!
In addition, the new METROPOLITAN offers you all of the
qualities of passenger comfort and safety that have
made the Convair first choice all over the world!

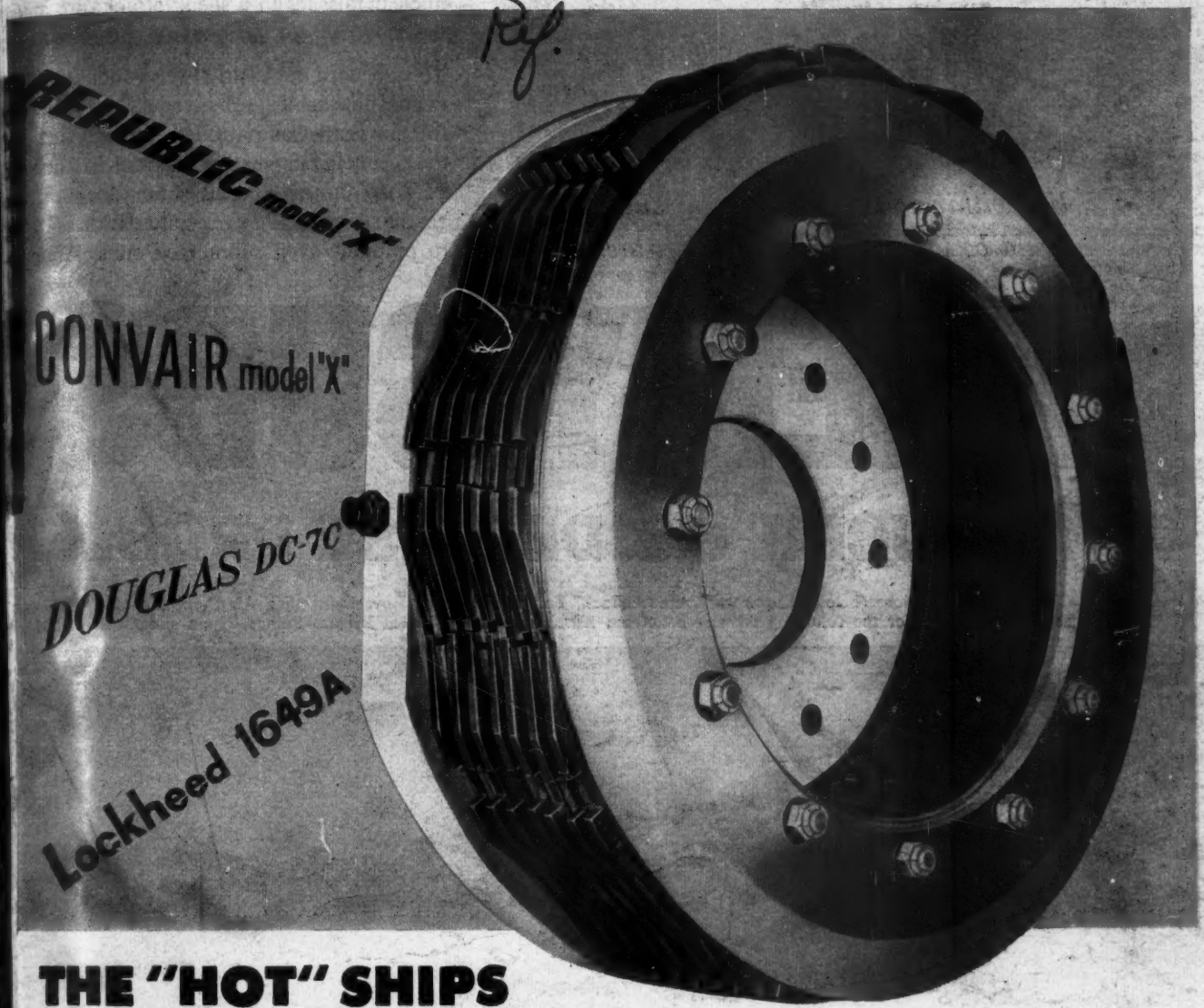
CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

Soon to fly on: S•A•S, Scandinavian • Sabena, Belgium • Swissair, Switzerland • Braniff • Continental • Delta • National • Real S.A., Brazil • Aero O/Y, Finland

Air Force April '56

Ref.



THE "HOT" SHIPS —THE BIG SHIPS

are choosing the super-brake with the built-in "heat sink"

—the NEW Goodyear TRI-METALLIC BRAKE!

It comes as no surprise that many of tomorrow's big and fast-flying aircraft are selecting the brake which gives up to *50% increase in absorption of kinetic energy per pound of brake.*

And so it is with the new Douglas DC-7C, Lockheed's Model 1649A and several new military planes on which model numbers have not been released.

Each of these aircraft specifies the new Goodyear Tri-Metallic Brake—the brake in which *the lining,* as well as its mating member and the brake structure itself, acts as a highly efficient "heat sink."

This increased heat absorption capacity per pound of brake is due to the fact that Goodyear has been able to combine the famed disc-brake efficiency with a new metallic lining material *—a non-insulating lining which operates at temperatures up to 70% higher than other designs of this type!*

The simplicity of design of the Goodyear Tri-Metallic Brake gives a spectacular reduction in number of parts—over 200 parts less than in other brakes of comparable capacity. This means greatly reduced inventory and maintenance man-hours.

If you are designing a new aircraft—if your brake problem would be simplified by these qualities—then by all means get the facts on this new brake. Write: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California.

FACILITIES + ABILITIES = EXTRA *plus* IN PERFORMANCE

Over one-fourth of the people in the U.S. live within range of atomic missiles that could be launched in a sneak attack by

Modern submarines, able to make long voyages while completely submerged, and to launch nuclear missiles in a sneak attack, are among the most sinister weapons of this atomic age.

To safeguard our nearly twelve thousand m[iles] of coastline against sub invaders, the U.S. N[avy] for ten years has patrolled immense area[s] of the ocean, in fair weather and foul, in Lockh[eed] P2V *Neptunes*. Special submarine detec[tion] gear enables the P2V, despite darkness or [fog], to pinpoint even submerged subs. And [its]

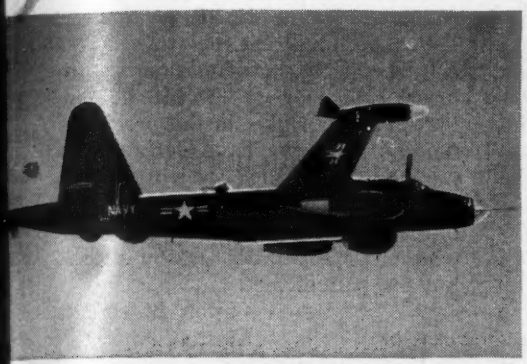
ENEMY SUBS!

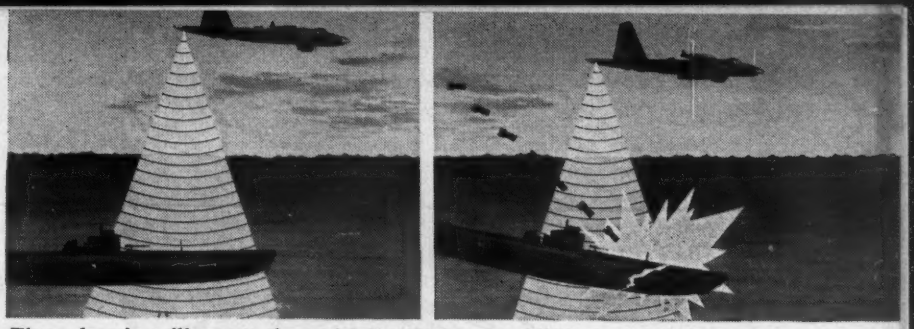
A CRUCIAL U.S. DEFENSE PROBLEM

Official R.A.A.F. photo (below) shows war games "attack" on British sub by Royal Australian Air Force *Neptune*. (P2V's are in military service for the following friendly countries: Australia, Canada, Great Britain, France, Japan and the Netherlands.)

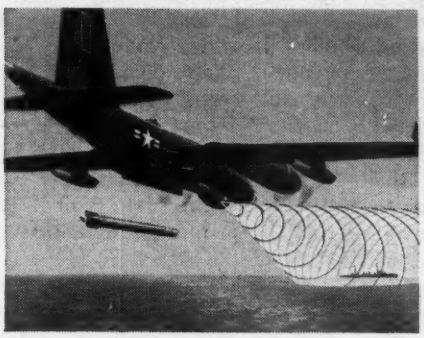
gressive modifications of the P2V have kept it militarily up to date at lowest cost to the Navy. Pound for pound, and dollar for dollar, the P2V *Neptune* is the most formidable patrol aircraft bearing the insignia of the U.S. Navy.

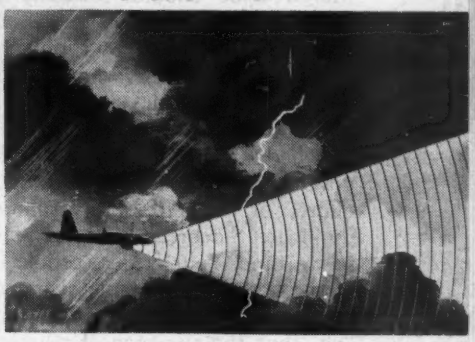
Recently the Navy awarded Lockheed its *24th* contract for P2V *Neptunes*—a tribute to Lockheed's leadership in weapons system management, the development and application of electronics, and the design and production of long-range patrol aircraft.





These drawings illustrate the multiple-mission capabilities of the P2V *Neptune:* **1** Low-flying P2V's electronic gear spots submerged sub because its presence distorts the earth's magnetic field. **2** Depth-bombing a submerged sub, **3** torpedoing a surface ship or laying mines to disrupt enemy shipping are jobs the P2V can do equally well. **4** Spotting hurricanes and reporting their velocity and direction are routine but important P2V missions which save human lives and vast sums in property damage.



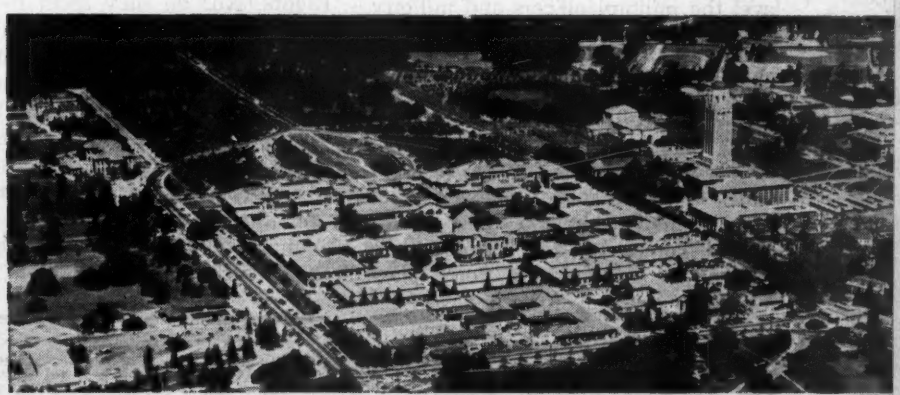


Lockheed Missile Research Laboratories to Be Built in Stanford's Industrial Park

A series of research laboratories will be constructed by Lockheed's Missile Systems Division on a 22-acre site adjacent to Stanford University, Palo Alto, California. On a nearby site of 275 acres, at Sunnyvale, Lockheed will build extensive new engineering, manufacturing and administration facilities. Lockheed's 3,000 scientists, engineers and technicians now developing guided missiles and unmanned aircraft at Van Nuys will transfer to Palo Alto and Sunnyvale as rapidly as construction permits.

The proximity of both new sites to Stanford will make the university's outstanding academic resources available to Lockheed research teams. And the new laboratory facilities to be built by Lockheed will provide Stanford scientists with technological tools and consulting opportunities hitherto unavailable.

ATTENTION, STUDENTS WHO DESIRE MASTER OF SCIENCE DEGREES: Lockheed's Advanced Study Program *helps students achieve MS degrees in Mathematics, Electrical and Mechanical Engineering, Aeronautics and other physical sciences. Write:* LOCKHEED MISSILE SYSTEMS DIVISION, *Van Nuys, Calif.* *(Below: aerial photo of Stanford campus.)*

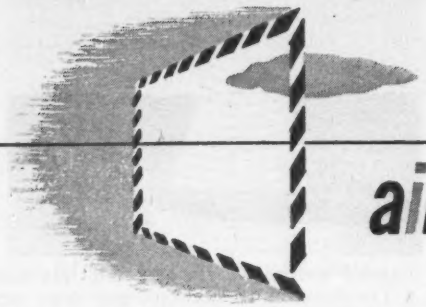


LOOK TO LOCKHEED FOR JET LEADERSHIP, TOO

LOCKHEED

AIRCRAFT CORPORATION

California Division, Burbank, Calif.
Georgia Division, Marietta, Ga.
Missile Systems Division, Van Nuys, Calif.
Lockheed Air Terminal, Burbank, Calif.
Lockheed Aircraft Service, Burbank, Calif.



air mail

More Respect for Ideas

Gentlemen: Your R&D article in the March issue should certainly go a long way in clarifying the issues on our "fly-before-you-buy" policy and in fact our whole governmental policy on research and development.

For more than a decade I have watched, from within and without government research programs, the efforts of peacetime government to duplicate the breakthroughs achieved in wartime. Your critical article is one of the best things I have ever read on the number of people who can say "no," but the shortage of people who can say "yes," or can lead or push to get something done faster.

One can't help feeling that with their form of government the Russians must be even more bogged down, and ordinarily that thought is our consolation. But when the Russians threaten to surpass us, we had better, in the old phrase, "look alive."

I'd like particularly to speak admiration for the comments on the subject of scientific manpower shortages. While it is true that we can use more scientists in the years ahead, particularly if we want color television as well as other items more related to survival, it is also true that we are not managing well the ones we have. We have no shortage of brains to match the Russians. At the operating level the military officers and military scientists have learned in the last ten years how to get along with each other. But at the top level our government still treats scientists as second-class citizens, and periodically some person of cabinet level speaks of them as if they were only one step from being demented butterfly-chasers.

Your comments are broader than the subject of the Air Force—they apply to research in other services and other parts of the government. They are also broader than merely questions of research, although that subject is crucial.

We have to have some wholesale revision of our means of treating persons who may have ideas.

We are scaring them out of government. Remember that not many months ago, Trevor Gardner was not approved for the job of Assistant Secretary, because he had been a friend of J. Robert Oppenheimer. Then recall that Gardner was under "investigation," with some vague hint of "conflict of interest" at the time he left. Thus Gardner came close to having been publicly damned at one time for associating with "subversives" and at another time for being too "capitalistic." He would only have been the second to be so completely bracketed by hostile fire, for Wolf Ladejinsky was the *first* to get crucified on both sides of the street.

So, in addition to your other gloomy but true analyses, I'd like to suggest that we aren't going to get men of ideas and energy into the government, from either business or the university campus, until we learn to be more hospitable to them and to their ideas.

Michael Amrine
Washington, D.C.

Dangerous Declaration

Gentlemen: I have waited in vain for a comment or editorial on what to me was the most calamitous announcement concerning the Civil Defense exercise "Operation Alert." That was the President's theoretical declaration of martial law for the entire country.

Apparently the people do not realize that with such a declaration they automatically lose about half of their constitutional rights, including some of the most important in the Bill of Rights. Nor do they seem to realize that even in theory, this contradicts the laws and spirit of our country.

Congress decided after the Civil War never to allow martial law for the entire United States. It is again written into the Civil Defense laws.

Should such an order actually be put into effect, we would, as of that moment, be under a dictatorship. Only the integrity of the President issuing that order, or the refusal of the armed forces to enforce it, would return the country to constitutional government.

Bear in mind that the armed forces exist specifically to defend our Constitution and way of life. If we lose these historic rights in the process of defense, then we have defeated our purpose even though we win the war. We as a nation will be in the position of the patient in the old medical cliché where "the operation was a success but the patient died."

Wilton B. Hodges
Kinston, N. C.

Air Museum Location

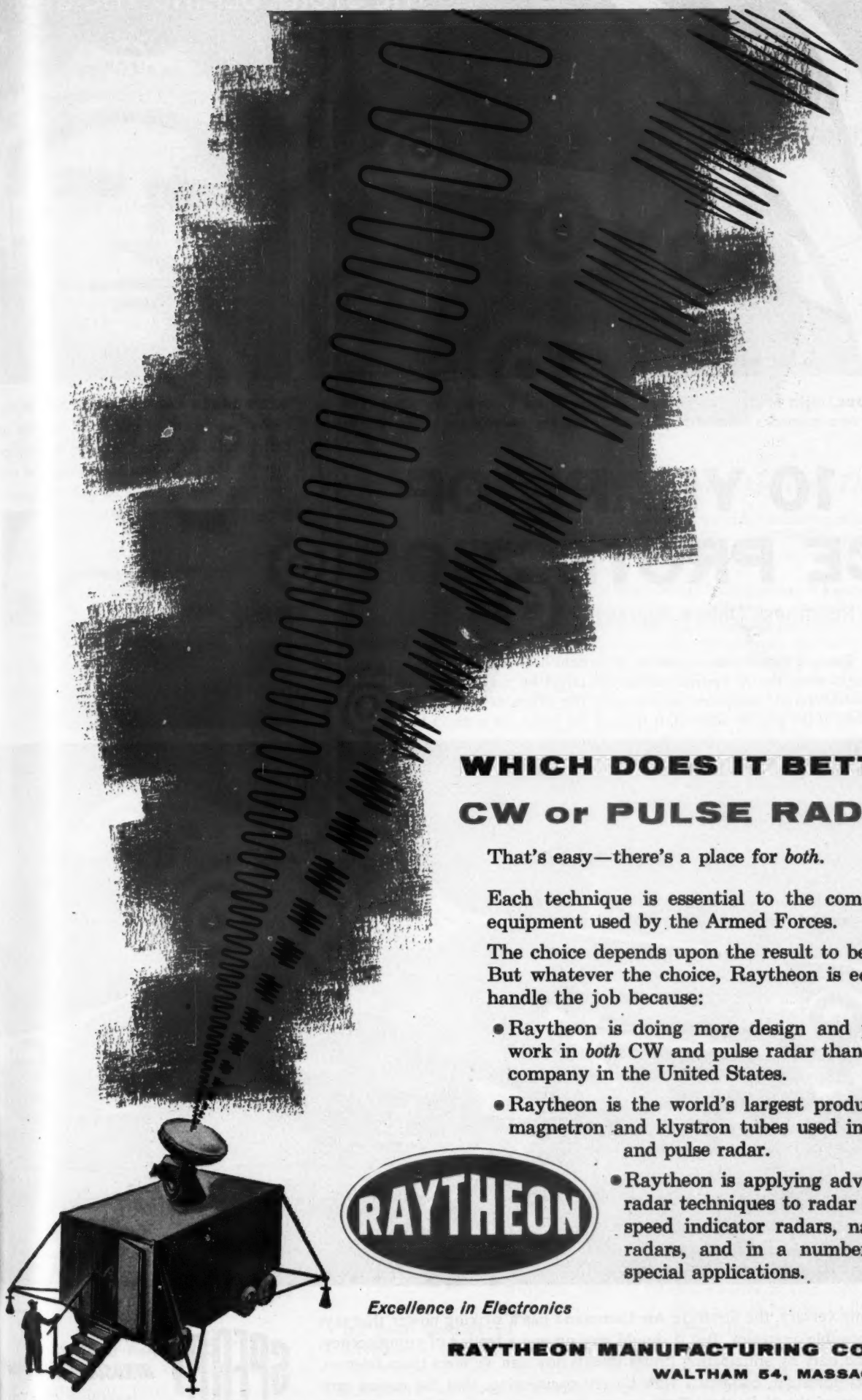
Gentlemen: For some time we have been watching with interest the discussion regarding the location of the Smithsonian Institution's Air Museum in Washington. The recent suggestion by Mr. Douglas Haskell, Editor of *Architectural Forum*, that the site be chosen in some outlying area, perhaps at an airport, has merit.

It is the opinion of many that an excellent location and site for such a museum exists today in suburban Washington near the University of Maryland, namely the historic College Park Airport. This airport—"the cradle of aviation"—could also be called the *first* Air Force base. Since it was first used in 1907, it has an illustrious history. Wilbur Wright instructed here, and many famous aviation pioneers, including General Arnold, learned to fly here. The first air mail service began in College Park in 1918, and the first aerial gun was fired at this airport. Here Henry and Emile Berliner worked on early helicopter developments.

The field is now privately owned and is therefore subject to real estate

(Continued on page 7)

AIR FORCE Magazine is published monthly by the Air Force Association. Printed in U.S.A. Re-entered as second class matter, December 11, 1947, at the post office at Dayton, Ohio, under the act of March 3, 1879. **EDITORIAL CORRESPONDENCE AND SUBSCRIPTION** should be addressed to Air Force Association, Mills Building, Washington 6, D. C. Telephone, Sterling 3-2305. Publisher assumes no responsibility for unsolicited material. **CHANGE OF ADDRESS:** Send old address *and* new address (with zone number, if any) to Mills Building, Washington 6, D. C. Allow six weeks for change of address. **SUBSCRIPTION RATES:** $4.00 per year, $5.00 per year foreign. Single copy, 35 cents. Association membership includes one-year subscription: $5.00 per year (Cadet, Service, and Associate membership also available). **ADVERTISING CORRESPONDENCE** should be addressed to Sanford A. Wolf, Advertising Director, 114 East 40th St., New York 16, N. Y. (MUrray Hill 9-3817). Midwest office: Urben Farley & Company, 120 S. LaSalle St., Chicago 3, Ill. (Financial 6-3074). West Coast office: Hugh K. Myers, Manager, 685 S. Carondelet St., Los Angeles, Calif. (DUnkirk 2-6858). **TRADEMARK** registered by the Air Force Association. Copyright 1956, by the Air Force Association. All rights reserved under Pan American Copyright Convention.



WHICH DOES IT BETTER— CW or PULSE RADAR?

That's easy—there's a place for *both*.

Each technique is essential to the complex radar equipment used by the Armed Forces.

The choice depends upon the result to be achieved. But whatever the choice, Raytheon is equipped to handle the job because:

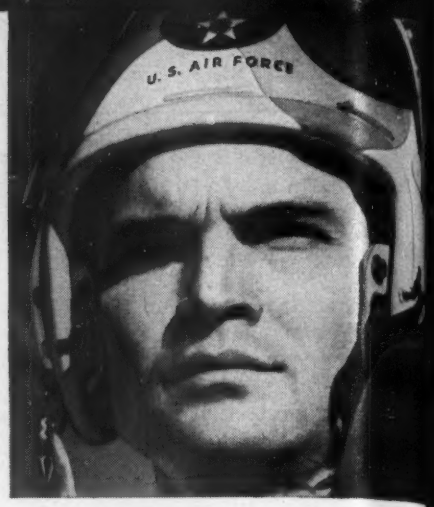
- Raytheon is doing more design and production work in *both* CW and pulse radar than any other company in the United States.
- Raytheon is the world's largest producer of the magnetron and klystron tubes used in both CW and pulse radar.
- Raytheon is applying advanced CW radar techniques to radar altimeters, speed indicator radars, navigational radars, and in a number of other special applications.

RAYTHEON

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY
WALTHAM 54, MASSACHUSETTS

THE STORY BEHIND THE STORY



FAIR WEATHER OR FOUL, night or day—long range bombers of the Strategic Air Command are ready to take to the air on a moment's notice, able to destroy any aggressor in any part of the world.

SAC's CRACK CREWS have the latest in precision equipment to make the best use of their precision training. Among their equipment is the K System for navigation and bombing developed for USAF by Sperry.

SAC: 10 YEARS OF PEACE PROTECTION

Round-the-Clock Readiness Deters Aggression

ACROSS THE WORLD Sperry Flight Controls and the K System help the pilot hold a fast, direct course. Nearing the target area, the K System locates the target by radar, helps the navigator-observer to plot his bombing run, computes electronically the effects of wind and speed on the bomb to be dropped. Then at the precise moment, it releases the bomb for a direct hit.

Today, on its 10th Anniversary, the Strategic Air Command has a striking power that says "Hands off!" to any possible aggressor. But it should give no one a feeling of complacency. Changes come fast, and only by anticipating future threats now can we meet them later on. It was through military foresight, combined with Sperry engineering, that the nation now has the defensive power of the K System. Tomorrow's defenses must be developed in the same way—by working ahead.

SPERRY GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION

development, the way so many other of our private airports have been lost. I would strongly urge that the possibility of locating the air museum at the College Park Airport be carefully considered and that such a study be made with some urgency before this historic field is lost forever.

F. T. McHugh
Baltimore, Md.

Ahoy There, Mate!

Gentlemen: I have received several applications from you for membership in AFA, and you will note I am applying for Associate membership.

Your three alternatives for membership are understandable, but my question is, why is the Naval Air Force never mentioned in the qualifications for active membership? I have noticed in many articles written by former Army Air Corps men that nothing is ever referred to that may admit that the Naval Air Force is on a level with themselves. We flew the same type aircraft and many times in the same locale, and with a common enemy.

D. F. Shier
Whittier, Calif.

• *Welcome aboard, Mr. Shier. Former Naval aviators, in fact all former Navy men, are eligible for Associate membership in AFA. However, the Air Force Association was formed by Army Air Force veterans and the constitution was framed with that in mind, as regards voting or holding office.—The Editors.*

Could Be

Gentlemen: I notice that the falcon is the mascot of the US Air Force Academy intercollegiate athletic teams.

Col. Benjamin B. Cassaday, Jr., who is now on the Academy staff, once was commanding officer of the 87th Squadron of the 79th Fighter Group. This group was called the Falcons. I wonder if he had anything to do with choosing the name?

S/Sgt. Lloyd S. Eide
Glasgow, Mont.

Rank Discrimination

Gentlemen: On page 45 of your March issue you refer to *Lt.* Gen. Thomas D. White. General White has been a four-star general for some time.

Air Force Major

• *The major is right. And we knew better! The general's date of rank is June 30, 1953.—The Editors.*

Proven Their Point

Gentlemen: I find myself in complete disagreement with Robert J. Jain's way of treating the Communist party ["Air Mail," January '56]. I would like to urge AFA "to come out flat-footed against it"!

From my point of view, the Communist nations in existence today have proven they stand for *just exactly what we spent two wars trying to correct.*

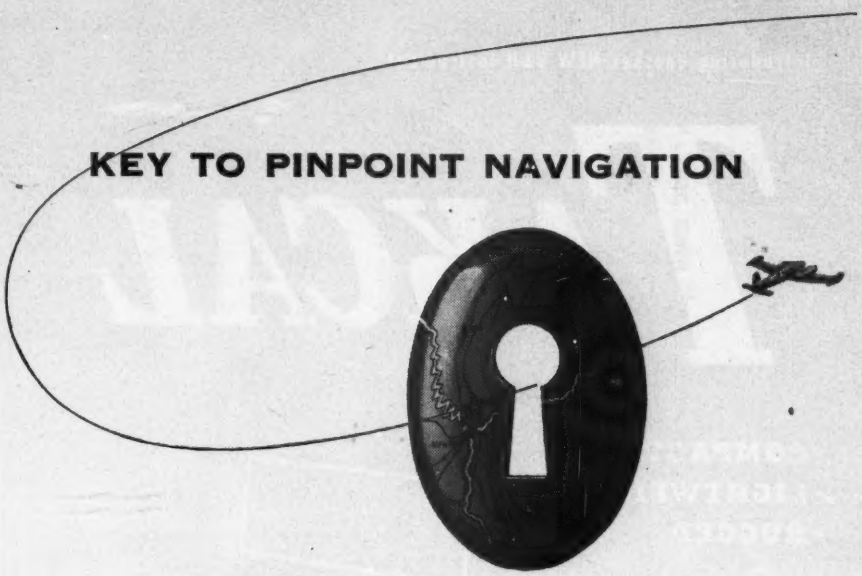
Philip H. Ewing
Hurlock, Md.

It's Been Considered

Gentlemen: I suppose the sonic boom has naturally been considered as a potent war weapon? It seems to me it would have considerable value say in blowing up dams or bridges—perhaps a better word for this would be "disintegrating."

Say a squadron of planes were sent to blow up a certain dam—they could come in at an invisible altitude and dive consecutively until the dam shattered beneath their sound waves; a half a dozen planes could dive and recover faster in this type of "bombing" than planes having to fly low through heavy flak to lay their eggs. A fast-moving, diving, and pulling-up plane is not an easy target to hit—and it

(Continued on following page)



Omni/ILS Plus **ARC's** *New Course Director*

This new and advanced navigation instrumentation system is a complete PACKAGE, consisting of single or dual omnirange equipment, teamed with the new ARC COURSE DIRECTOR.

The COURSE DIRECTOR consists of a computer which gives precise steering data and a compass slaved gyro which provides *stabilized,* accurate, directional information.

The system supplies the pilot with AUTOMATICALLY COMPUTED steering information on all ENROUTE OMNI TRACKS, HOLDING, INBOUND, OR OUTBOUND ILS OPERATIONS, thus providing PRECISE APPROACHES. Complete automatic crosswind compensation is provided for ALL operations.

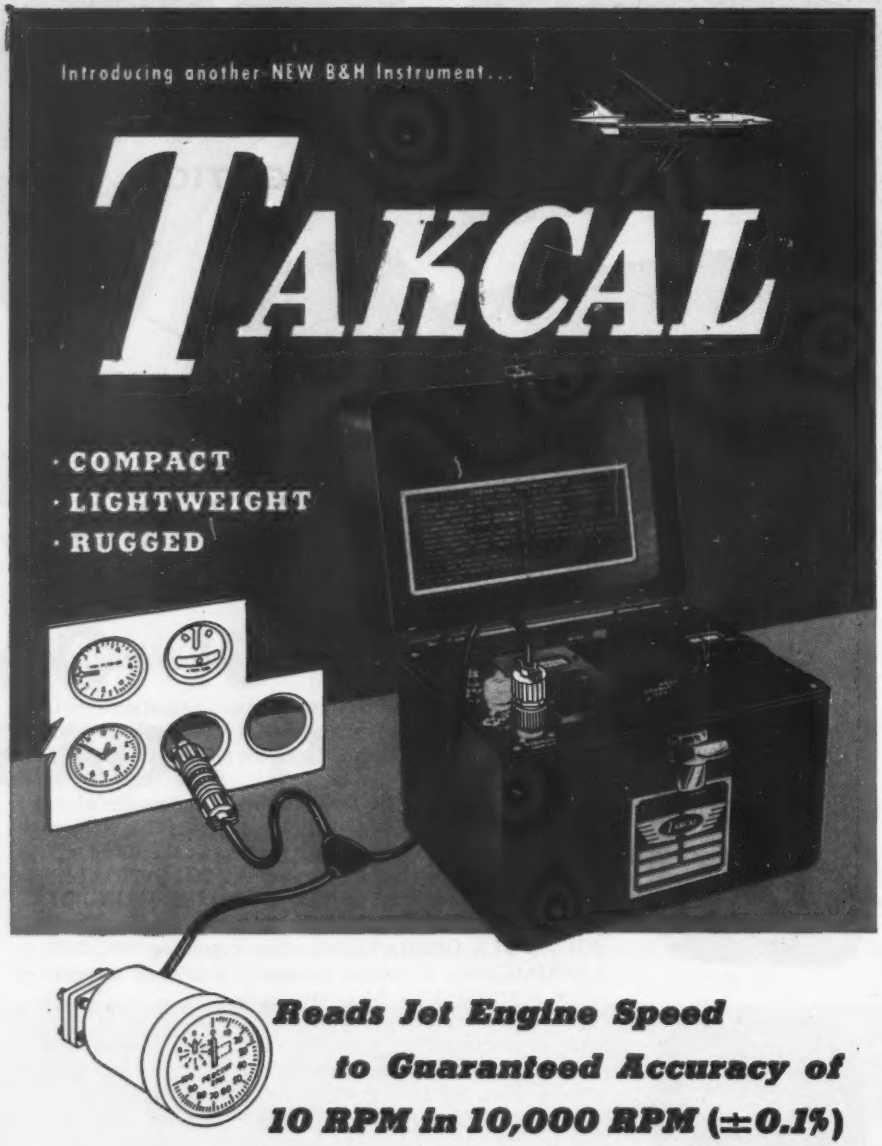
The computer performs all your calculations and presents correct steering data directly on the cross-pointer meter. The gyro needs no resetting at any time, since precession is completely compensated. *You simply set in your selected course and steer to keep the needle centered.* The system will then either intercept or precisely follow the desired track as required.

So – fly with pinpoint precision – greater ease and increased safety. See your nearest ARC Dealer or write for detailed illustrated data.

Omni Receivers • 900-2100 Mc Signal Generators • UHF and VHF Receivers and Transmitters • 8-Watt Audio Amplifiers • 10-Channel Isolation Amplifiers • LF Receivers and Loop Direction Finders • CD-1 Course Directors

ARC **Aircraft Radio Corporation** BOONTON, NEW JERSEY

Dependable Airborne Electronic Equipment Since 1928

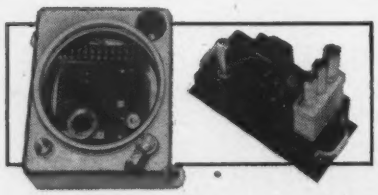


Reads Jet Engine Speed to Guaranteed Accuracy of 10 RPM in 10,000 RPM (±0.1%)

The new B&H TACKAL incorporates a refinement of the frequency meter principle. It operates in the low (0 to 1000 cps) range, reading the frequency of the tachometer generator on a scale calibrated in percent RPM corresponding to the engine's RPM. In addition the TAKCAL checks the tach system. The TAKCAL circuit and tachometer are parallel so that readings can be made simultaneously to determine the accuracy (or inaccuracy) of the aircraft's tach system. The TAKCAL operates during the engine run to properly set up engine controls for maximum economy and safety.

Originally developed as a component part of the J-Model JETCAL ANALYZER, the TAKCAL is now available as a separate unit for use with all earlier models of the JETCAL TESTER.

The TAKCAL operates accurately in all ambient temperatures from —40°F. to 140°F. Low in cost for an instrument of such extreme accuracy, it is adaptable to application in many other fields.



Explosion-proof TAKCAL for special applications. Measures 200 to 7500 RPM, direct reading, with ±0.1% accuracy.

For full information write or wire . . .

TAKCAL

B & H INSTRUMENT CO., INC.

3479 West Vickery Blvd., Fort Worth 7, Texas

AIR MAIL.....CONTINUED

wouldn't have to fly so low to accomplish this type of mission.

If it can shatter wood and glass—how about metal and stone?

Hallie Smith
Oxford, Ind.

Tough "Break"

Gentlemen: Col. H. T. McCormick, in his letter to the editors, March issue, rightly questions use of the word "brakes" in my account of a flight over the early cross-country air-mail route [January 1956, AIR FORCE]. "Brakes" must have represented an unconscious euphemism. Switch off, throttle back, a good earnest prayer, was how a DH-4 could be made to stop—except downhill.

Samuel Taylor Moore
Washington, D.C.

Highest Morale

Gentlemen: I would like to express my opinion about Mr. Arthur Godfrey's article, reprinted in the February issue of AIR FORCE Magazine.

After serving four years in the Air Force — three and one-half of them at SAC bases—from the home of the B-36, Carswell AFB, Fort Worth, Tex., to one of the most wintery climates of the United States that the B-36 could come up against at Loring AFB, Limestone, Me.—I want to say that all the flying status and combat crew personnel that I had dealings with never had any fear or intention of mutinying.

I've worked with flight surgeons in performing the annual flying physicals. Every member was eager to pass the examinations, not in fear of getting grounded or losing their flight pay, but for the sole reason of not wanting to break up their B-36 crew. These men have the best teamwork and highest morale of any airmen, because they are crew members of one of the best aircraft the USAF has ever come across in performance and safety—the Convair B-36.

Paul B. Remy
Central Falls, R.I.

● *In his article, Mr. Godfrey was not criticizing the B-36, as Reader Remy seems to feel. Mr. Godfrey, discussing the lack of public understanding about SAC and its equipment, said that some of his "badly misinformed friends" even believed that SAC crews would fly the B-36 "only at gunpoint." Actually, of course, this was never the case. We believe, with Mr. Godfrey, that the B-36's record speaks for itself. For more about the B-36, see the article beginning on page 82.—The Editors.*

SPLIT SECOND MEN...

thru Electronics

Paul Revere's famous ride in 1775 brought into action the famous "Minute Men"... in defense of their homes and freedom.

Today our nation also takes pride in the Air Force's "SPLIT SECOND MEN" who are on a 24-hour alert ready to defend our homes and freedom against any possible aggressor. Electronic systems such as powerful radar, lightning-fast computers and reliable communications make this possible.

The HMEE DEPARTMENT* of the General Electric Company is completely dedicated to the design, development and production of military electronic systems used in the defense of our nation ....

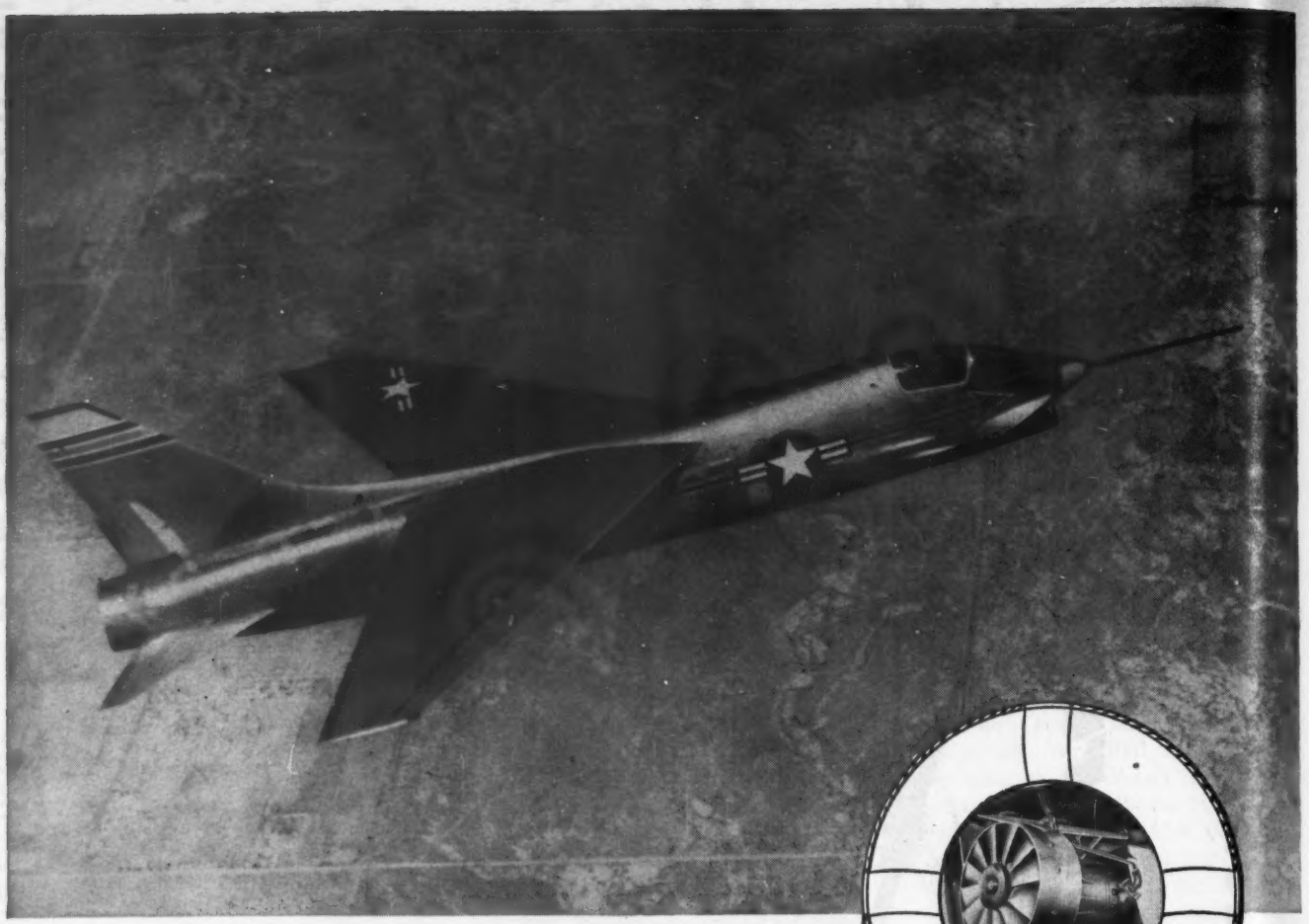
Engineers interested in a challenging opportunity write for booklet "New Horizons," General Electric Company, HMEE DEPT.* (5), Syracuse, N. Y.

A LEADER IN
SYSTEMS DEVELOPMENT AND ENGINEERING

Progress Is Our Most Important Product

GENERAL ELECTRIC

* HEAVY MILITARY ELECTRONIC EQUIPMENT DEPARTMENT • SYRACUSE, N.Y.



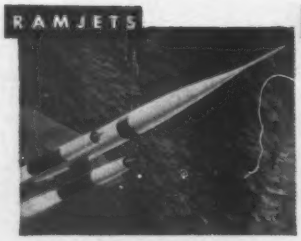
The Chance Vought F8U-1 Crusader, newest of the Navy's jet fighters, is equipped with a Marquardt ram-air emergency power package. In case of engine failure the unit pops into the air stream and supplies A-C, D-C, and hydraulic power sufficient to maintain flight control and communication through all speeds down to safe landing.

Lifesaver... WHEN POWER FAILS.

Marquardt Aircraft, the West's largest jet engine research and development center, is an important contributor to the OMAR Joint Technical Committee. With Reaction Motors, first in the American rocket industry, and Olin Mathieson Chemical, a leading producer of chemicals, explosives, metals, Marquardt adds greatly to a continuous joint technical effort to achieve improved rocket and ramjet engines and special fuels. Exemplifying the weapons systems concept in action, the OMAR Committee combines for the first time both chemical and mechanical experience applicable to high-energy power generation.

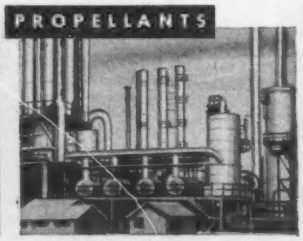
Engineers, chemists, physicists, production and tool specialists... a wide variety of fascinating careers await you on this weapons systems team. For information write OMAR Employment Officer at the company nearest you.

RAMJETS



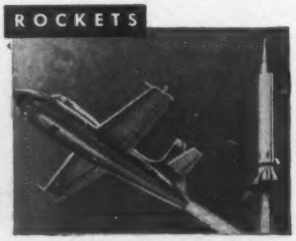
Marquardt Aircraft Company
Van Nuys, California

PROPELLANTS



Olin Mathieson Chemical Corp.
New York, New York

ROCKETS



Reaction Motors, Inc.
Denville, New Jersey

MARQUARDT AIRCRAFT
OLIN MATHIESON CHEMICAL
REACTION MOTORS

OMAR

wing tips

By Wilfred Owen

There are nearly 7,000 civil and military airports in the United States.

• • •

Last October 16 a Boeing 707 jetliner flew from Seattle to Washington, D.C., and back the same day at an average speed of 580 miles per hour.

• • •

Business aircraft are now flying 4,000,000 hours a year, a million more hours than the domestic airlines. CAA predicts that executives of 1965 will be spending 7,500,000 hours in company planes.

• • •

Pan American Airways, with 63,000 miles of routes and 1,264 pilots, serves all the inhabited continents of the world. To keep track of the airline's business requires an electronic data processing machine that rents for $30,000 a month.

• • •

Among the various reasons for delayed aircraft departures add the latest from TWA. A plane bound for Pittsburgh from New York's La Guardia was held up twenty minutes while a search was conducted for an unticketed mouse, reported by an unsympathetic hostess. The search was fruitless and the mouse presumably made Pittsburgh.

• • •

The Society of Automotive Engineers reports that foreign objects left in the inlet ducts of jet aircraft by careless

mechanics can cause serious repair problems when sucked into the turbine blades. Among the common articles plugging up the works are hats, gloves, wrist watches, and ham sandwiches.

• • •

Even objects lying around the runways can be sucked into the jets and cause considerable damage. Baltimore's Friendship Airport has tackled the problem with a huge airport vacuum cleaner that can clean two million square feet of runway in eight hours. This latest housekeeping appliance picks up rocks, bolts, gravel, concrete chips, water and light snow, at an intake rate of 350 miles per hour.

Sorry—Suites at the Roosevelt Sold Out!

Here's a handy way to make sure you have a room at AFA's 1956 National Convention in New Orleans—see pages 148 and 149 for details. The headquarters hotels for the Convention are the Roosevelt and the Jung.

HOTEL RESERVATIONS

The four New Orleans hotels listed below have reserved 1,500 rooms for the Air Force Association's 1956 Convention and Airpower Panorama. A special housing office has been established at the New Orleans Convention Bureau to handle hotel reservations for the Convention. All reservation requests MUST be sent to the AFA Housing Office, not to AFA in Washington or directly to the hotels. All four hotels are air conditioned. No advance deposits are required.

ROOM RATES

HOTEL	SINGLE	DOUBLE	TWIN
Roosevelt	$7-8-9	$10-11-12	$14-15-18
Jung	$7-8-9	$10-11-12	$11-12-14
St. Charles	$6-7-8	$ 9-10-11	$11-13-15
Monteleone	$6-7-8	$ 9-10-11	$11-13-15

Parlor Suites

One Bedroom . . . . $25 & Up

Two Bedroom . . . . $40 & Up

FILL IN, CLIP AND MAIL TODAY!

mail to: AFA HOUSING OFFICE
New Orleans Convention Bureau
315 Camp Street
New Orleans 5, La.

Date.....

NAME .....

ADDRESS .....

CITY & STATE.....

HOTEL..... .....
First Choice Second Choice

....
Type Room Desired Rate

ARRIVAL DATE & HOUR.....

DEPARTURE DATE.....

OTHERS IN ROOM.....

... .

AIRPOWER IN THE NEWS

By Lee Klein

■ In the strange new supersonic and high temperature world that aviation is entering, a **phenomenon known as "creep"** may place a limit on the amount of time an aircraft can fly at the high temperatures encountered. According to **George S. Schairer, assistant chief engineer at Boeing,** "At elevated temperatures a loaded structure will have a deflection which increases with time, and **a residual permanent set will result** from prolonged loading." Stated simply, this means that the wings, for instance, might bend under load at high temperatures and **remain permanently bent.**

■ British test pilot **Peter Twiss** flew a **Fairey Delta 22** jet fighter at an **average speed of 1,132 mph** over a nine-mile course on March 10. Upon official confirmation by the *Féderation Internationale Aeronautique,* England will have recaptured the world speed record from the US (held by **Col. Horace H. Hanes,** USAF, who flew 822.135 mph in a North American F-100C Super Sabre).

■ Washington's **Bolling AFB** is scheduled to be abandoned—as far as flight operations are concerned—by the Air Force, and **flying activities will be transferred to Andrews AFB, Md.** The AF, making this known to a Senate Commerce subcommittee, said the fact that Bolling is "getting outdated" and the **increased congestion at National Airport** across the river were the main reasons for deciding on the move. The plan was revealed by **Brig. Gen. Ralph E. Koon** who testified in opposition to a Commerce Department recommendation that the airlines share Andrews with the AF. He said the AF opposed this because civilian and military aircraft are not compatible and also because Andrews will be operating at capacity in the future. Bolling will be used for additional AF offices and housing.

■ Bombers and missiles—including the much discussed ICBM of the future—will become "sitting ducks" for defensive weapons according to **Dr. Walter R. Dornberger,** guided missiles expert for the **Bell Aircraft Corp.** The former commander of the German rocket center at Peenemünde, where the V-1 and V-2 that were used against the British were developed, nevertheless urged that the ICBM be developed rapidly by the US. Speaking before the **Aviation Writers Association** at the National Press Club in Washington, he said that the ICBM would create a stalemate that would eventually lead to renewed dependence on the bomber as a weapon.

Dr. Dornberger **attacked red tape** that consumes "years before a military requirement will be written down." Discussing the problems under the present set-up, he said, "The industry has to convince at least 200 different people in at least twenty different offices and committees before a new project can start. Most of these people change every two years. They have different opinions and have to be convinced again. **Too many people, too many questions, too many answers."**

Wide World Photos, Inc.

Edward P. Curtis is welcomed to his new job—Special Assistant for Aviation Facilities Planning—by President Eisenhower. Curtis is an Eastman Kodak VP and an AFA founder.

Wide World Photos, Inc.

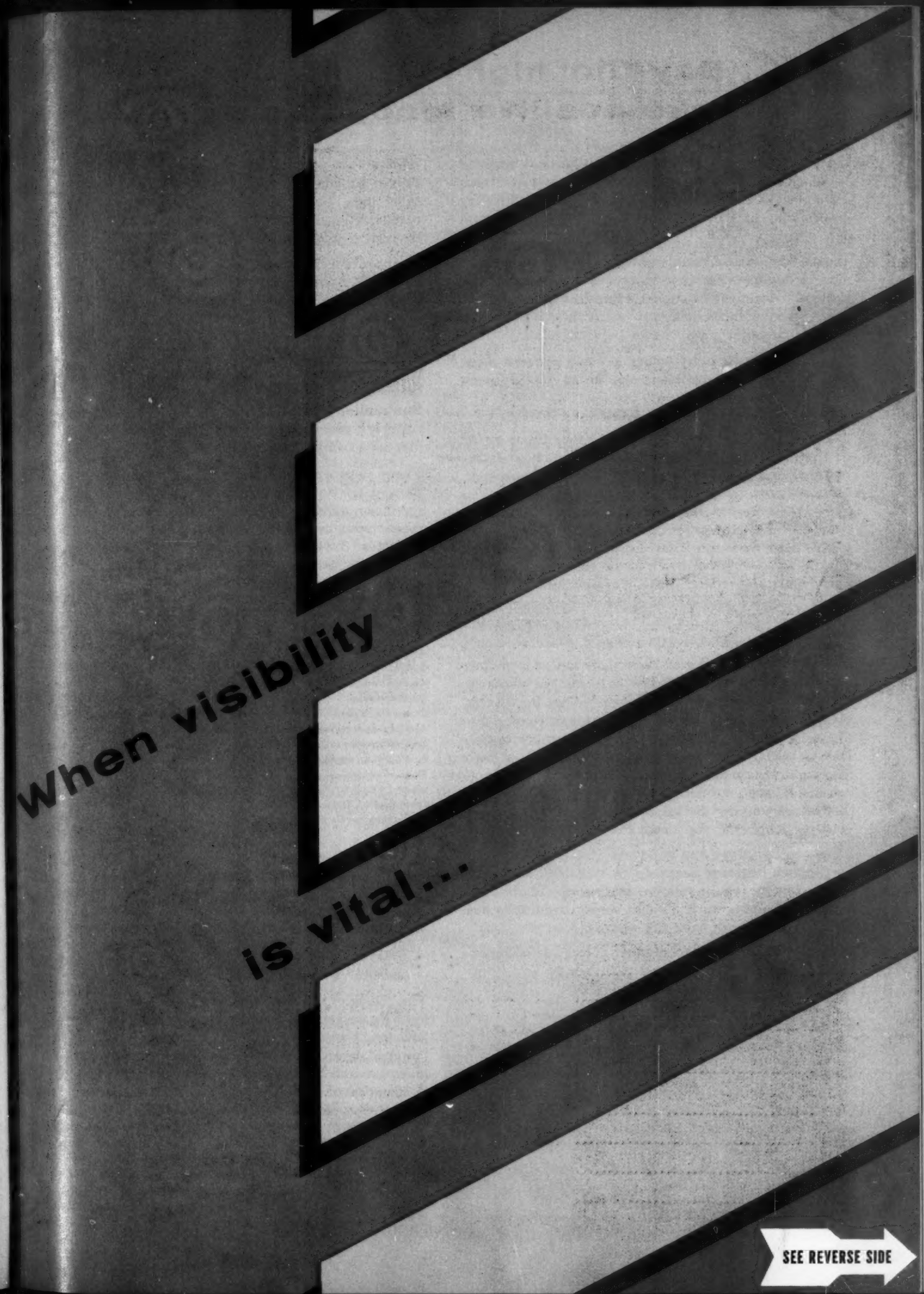
Visiting the Pentagon, Italian President Giovanni Gronchi chats with Gen. Nathan F. Twining and Gen. Curtis LeMay.

■ **Maj. Gen. James E. Briggs** (see cut), Assistant Deputy Chief of Staff for Operations, Hq., USAF, will replace **Lt. Gen. Hubert R. Harmon** as Superintendent of the AF Academy in August. During World War II, General Briggs served with the Eighth Fighter Command in Europe, and later served with the Strategic Air Command, as Chief of Staff of the Fifteenth AF, and as a bomber wing commander. He went to the Far East during the Korean war as Commander of the Far East Bomber Command.

The new Academy, now nearing completion of its first year of operation, is temporarily located at Lowry AFB, Colo. Last month, **Secretary of the AF Donald A. Quarles** approved the plans for the very modern permanent plant at Colorado Springs, Colo. The AF has apparently overcome the resistance of a group of Congressmen who denounced the original plans because they were so starkly modern, with large expanses of glass walls in the buildings. The approved designs, by **Chicago's Skidmore, Owings and Merrill,** are much like those originally unveiled by the AF (see AIR FORCE, July 1955). Final design for the chapel—**most controversial structure** in the original plans—has not yet been worked out.

■ Two Tactical Air Command pilots recently flew **from California to Langley AFB, Va., in three hours and thirty-four minutes** in **Republic F-84F Thunderstreak** jets. The trip, flown at an **average of 672 mph,** was made without landing or refueling to demonstrate the capabilities of pilot and aircraft in a "maximum range and cruise control" mission. It **was not a record try,** even though the time was better than the current transcontinental speed

(Continued on page 15)


When visibility
is vital...
SEE REVERSE SIDE

Day-Glo® high-visibility colors make positive recognition easy

Speed of movement is essential to National Security —but speed can defeat its own purpose unless America's defenders can see where they are going and what they are looking for.

All branches of the Armed Forces urgently need improved means of visual sighting and visual identification in daylight. Familiar objects are often extremely difficult to locate and frequently impossible to recognize at the speed of modern aircraft, ships and land vehicles. Unfamiliar objects may never be seen at all.

DAY-GLO high-visibility colors, as demonstrated overleaf, provide one important answer to this problem.

FOUR DISTINCTIVE ADVANTAGES

1. DAY-GLO colors are visible up to four times as far as the brightest of ordinary colors (such as International Orange) because they are *daylight fluorescent.* Ordinary, non-fluorescent colors simply reflect to the eye of the observer a small portion of the visible light from the sky. Not only do DAY-GLO colors reflect visible light, they also EMIT visible light by transforming the wave-length of much of the energy which ordinary colors absorb and waste. For example, DAY-GLO Blaze Orange absorbs ultra-violet, violet, blue, green and yellow light and EMITS much of this energy in the form of orange light of exceptional purity.

2. The extreme purity of their light emission makes DAY-GLO colors distinguishable *as to color* at distances at which ordinary, non-fluorescent colors appear as black, white or are unseen. Their amazing color distinguishability can be demonstrated by comparing this DAY-GLO Blaze Orange announcement in daylight with the brightest non-fluorescent red, yellow or orange you can find. Place your samples side by side and observe them from varying distances. Your eyes will astonish you—*particularly if you make this test on a dark day.*

3. On overcast days, and at dawn and dusk, when ordinary colors decrease seriously in visibility, DAY-GLO colors INCREASE in relative brightness. Their fiery appearance under such difficult seeing conditions has caused a number of false fire alarms.

4. DAY-GLO colors are "command colors". It is impossible to ignore them. They turn heads and command attention.

NOW AVAILABLE IN NEW PAINTS AND OTHER LONG-LIFE MATERIALS

The earliest DAY-GLO colors were battle-tested in the Second World War. R. C. & J. L. Switzer introduced them during that conflict, primarily in the form of daylight fluorescent fabrics. Many millions of yards of such fabrics were supplied to American and Allied Armed Forces for air-to-ground signal panels and numerous other uses. These early signal fabrics made a widely recognized contribution to victory, despite the fact that they faded rapidly during exposure to direct sunlight.

Now Switzer Brothers have developed an entirely new line of Sunbonded® DAY-GLO Paints which have a useful outdoor life of many months instead of weeks, even under severe conditions of exposure. Moreover, the extended lightfastness of the Sunbonded DAY-GLO Paints themselves can be *doubled* by overcoating them with the Switzer-developed DAY-GLO *Filteray®* which functions as an optical filter. In certain applications, Sunbonded DAY-GLO Paint, plus Filteray, offers superior visibility and color-distinguishability for as long as a full year of outdoor exposure.

These improvements in durability have been accompanied by equally significant reductions in cost. Furthermore, the colors are manufactured in dry pigment form, making it possible for Switzer Brothers to formulate daylight fluorescent coatings to meet widely varying needs and conditions of application.

The practical uses of the Switzer colors by land, sea and air have been broadened correspondingly. They now include:

- Aircraft and airport markings
- Buoys
- Channel markers
- Decalcomanias
- Danger warnings
- Ditching and survival gear
- Emergency rescue equipment
- Fire fighting equipment
- Flags—Banners
- Guided Missiles
- Identification Devices
- Instrument Panels and Dials
- Life-saving equipment
- Location markers for supplies and equipment
- Obstruction markings
- Optically tracked devices
- Recognition panels
- Recoverable equipment (exercise torpedoes, etc.)
- Rockets
- Safety gear
- Signal devices
- Tow targets for high-speeds

DAY-GLO materials (without Filteray) are fluorescent in "black" light (filtered ultra-violet) as well as in daylight.

A CHOICE OF SEVEN DAY-GLO COLORS

Blaze Orange • Arc Yellow • Fire Orange • Saturn Yellow • Neon Red • Signal Green • Rocket Red

The choice of the most effective type and color of daylight fluorescent material for any specified purpose is governed by definite technical considerations. The unmatched record of experience compiled by Switzers as inventors and developers of such materials is freely at the disposal of authorized representatives of the Armed Forces. Samples of DAY-GLO materials may likewise be obtained by making written request. Please address

Department M, SWITZER BROTHERS, INC.
4732 St. Clair Avenue • Cleveland 3, Ohio

DAY-GLO® color products are approved for high-visibility use by numerous Government agencies

In August, Maj. Gen. James E. Briggs becomes AF Academy Superintendent replacing Lt. Gen. Hubert R. Harmon.

record. The flight was made by **Lt. Col. Robert R. Scott** (holder of the current official record) and **Lt. Richard J. Hill III,** both of the 510th Fighter-Bomber Squadron of the 405th Fighter-Bomber Wing based at Langley. They took off from Norton AFB, San Bernardino, Calif., and streaked across the country at altitudes ranging from 31,500 to 41,500 feet. When they landed at Langley they had **enough fuel left to travel an additional 400 miles.**

■ AIRPOWER NOTES . . . The AF, queried about flight safety after **eight major crashes** in a little over two months, said that the accident **rate is still going down**—in spite of a big increase in operations. . . . A course on "Parachute Engineering," to stimulate research and study in this area, will be offered at **Purdue University, West Lafayette, Ind.,** this June. . . . The House Committee studying the **Navy's Demon jet project** said that **"The Navy, Westinghouse, and McDonnell** must share the **responsibility for errors** of judgment and waste of public funds. The final responsibility rests with the Navy." . . . **AF Chief of Staff Gen. Nathan F. Twining** has told a House subcommittee, "We should have nuclear bombs in airplanes all the time and be ready to go. We must reduce our reaction time, the time it takes to get bomb-loaded planes off the ground." . . . **An agreement between the US and Britain** will finally enable each nation to develop and build jet engines with a complete understanding of conditions they must meet to be sold abroad. Differences of aircraft engine standards have been **a stumbling block in trade** between the two nations. . . . Some of the AF's **Boeing B-52 Stratofortress** bombers are now back in flying status. The giant bombers were grounded in February following a crash caused by fire due to a malfunctioning electrical system. The rest of the planes will fly as soon as corrective action is taken on them. . . . **Maj. Gen. Floyd B. Wood,** ARDC Deputy Commander for Research and Development, has likened research and development to fire insurance. "You have to purchase the insurance before the fire starts," he said, "if it is going to do you much good." . . . For the first time, **air travel insurance** at commercial airline rates will be made **available soon to MATS passengers** through Tele-Trip Policy Co., Inc., a subsidiary of **Mutual of Omaha.** . . . The annual reunion of the **Doolittle Tokyo Raiders** will be held in Tampa, Fla., **April 13-16. . . . Maj. Gen. James B. Newman,** USAF-Ret., has been nominated for president of the Society of American Military Engineers. . . . **Dr. William J. Jacobi** and **Dr. Howard S. Seifert** of the **Ramo-Wooldridge Corp.,** have been appointed to the 1956 technical subcommittees of the **National Advisory Committee for Aeronautics.** . . . **Lufthansa German Airlines** will buy four **Boeing 707** jet transports, and **KLM Royal Dutch Airlines** is reportedly ordering twelve **Lockheed Electra** turboprop airliners. . . . The AF plans to **air-drop an entire scientific base,** consisting of 485 tons of material for buildings, radio stations, equipment and supplies, **at the South Pole.**

■ STAFF CHANGES—**Brig. Gen. Ben I. Funk** has been relieved from duty as Assistant for Programming, AMC, Wright-Patterson AFB, Ohio, and assigned as Deputy Director for Ballistics Missiles, Western Development Division, AMC, Los Angeles, Calif. . . . **Brig. Gen. Lawrence M. Guyer,** Chief of Staff, ConAC, Mitchel AFB, N. Y., will be assigned to the Far East Air Force as Junior US Resident Member and Chief of Staff of United Nations Military Armistice Commission about April 15. . . . **Maj. Gen. Earl W. Barnes,** Deputy Commander, TAC, Langley AFB, Va., has been nominated for promotion to lieutenant general and will succeed **Lt. Gen. Elmer J. Rogers** as Chief of Staff, Far East Command, Tokyo. General Rogers will be assigned to the USAF Command and Staff, Washington, D. C. as Inspector General replacing **Lt. Gen. Truman H. Landon** who will take a voluntary reduction to the rank of major general for assignment as Commander, Caribbean Air Command, Albrook AFB, Balboa, C. Z. . . . **Maj. Gen. Frederic H. Smith,** nominated for three-star rank, is now Vice Commander of Air Defense Command, Ent AFB, Colo. He will replace **Lt. Gen. Roger M. Ramey** as Commander of the Fifth Air Force, Nagoya AB, Japan. General Ramey will become Deputy Commander-in-Chief, Continental Air Defense Command and Vice Commander of ADC. . . . **Brig. Gen. Hollingsworth F. Gregory** has assumed command of the Air Force Office of Scientific Research, ARDC, Baltimore, Md., filling the position vacated by **Brig. Gen. Don D. Flickinger,** who became Commander of the ARDC European Office, in January. **Maj. Gen. Floyd B. Wood** will be relieved from duty as Deputy Commander, Research and Development, ARDC, Baltimore, Md., and become Commander of the AF Flight Test Center, Edwards AFB, Calif., about June 1. . . . **Brig. Gen. Marvin C. Demler,** Asst. Deputy Commander, ARDC, Baltimore, Md., will replace General Wood as Deputy Commander. . . . **Brig. Gen. Norman D. Sillin,** Comptroller, SAC, will replace **Brig. Gen. James B. Burwell** as Deputy for Operations, ConAC, at Mitchel AFB, N. Y.—END

Col. Robert R. Scott (in cockpit) checks log with Lt. Richard Hill III after the two made a 672 mph non-stop flight from California to Langley AFB, Va. (see text)

FOR 3000 PSI PNEUMATIC SYSTEMS

SOLENOID VALVES
REGULATORS
INTERLOCK VALVES

Stratos' Western Branch now is turning out solenoid valves and pressure regulators for 3000 psi pneumatic systems. Light, reliable, precision-built, they complement the large group of Stratos pneumatic equipment for aircraft.

Model 7008 solenoid valve assembly

Exploded view of Model 7006 solenoid valve core, assembly and body

Model 7009 solenoid valve core

Photos not to scale

Solenoid valves are made in two types, each produced as: normally closed, normally open, and normally closed with manual override. Designed for continuous duty in aircraft pneumatic systems, Stratos 3000 psi solenoid valves are compact, light, and simple to install. Drawing less than 1 amp, they are fast acting (0.020 sec.) and their reliable performance remains unaffected by temperatures of −65°F to over 165°F.

Flow capacities are equivalent to a 0.040" sharp edge orifice for the direct-operated size and to 0.312" for the larger air relay type. The solenoid of the smaller model is used in the higher-flow air relay unit.

Both types are available as either complete units—or as core and seat assemblies which can be threaded into housings integral with the mechanism to be controlled.

Model 7002 pressure regulator

Pneumatic Pressure Regulators by Stratos provide a wide range of adjustable downstream pressures and are designed to operate with 3000 psi supply.

The high flow model, with a flow capacity equivalent to a .115 diameter sharp edge orifice, can be adjusted to downstream pressures from 400 to 1500 psi. Downstream proof on this pilot operated unit is 5000 psi.

The poppet-type, medium flow regulator illustrated delivers a capacity equivalent to a .035 diameter sharp edge orifice, adjustable downstream pressures range from 100 to 800 psi., proof pressure is 1500 psi.

INTERLOCK VALVE
pneumatic/electric

Pressure:
Rated 400 to 1500 psi.
Proof 3000 psi.
Burst 4000 psi.

Control: Mechanical. Interlock switch rating at 30 V dc or 250 V ac is 10 amps.

Weight: 1.2 pounds

Ambient temperature range: −60°F to 165°F.

Provides pneumatic and electrical interlock to prevent premature energization of devices in series with actuator of interlock valve.

For more complete data on Stratos' 3000 psi solenoid valves and pressure regulators, write to: Stratos' Western Branch: 1800 Rosecrans Avenue, Manhattan Beach, California

Stratos Western Branch also makes:

ACTUATORS • COMPRESSORS • EJECTORS • CONTROLS

STRATOS

A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

Main Plant: Bay Shore, L.I., N.Y. Western Branch: 1800 Rosecrans Ave., Manhattan Beach, Calif.
West Coast Office: 1355 Westwood Blvd., Los Angeles, Calif.

Accessory systems and precision equipment for aircraft